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The Engineering and Mining Journal

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Production of Lead

Our revised statistics of the production of lead in the United States in 1911 are given in the accompanying tables, the first of which is based on reports received by all of the refiners, classified as in previous years, i.e., the lead reported as "desilverized" and "antimonial" is the product of the refiners treating Western and foreign bullion, while the production of the Missouri and Illinois refiners is entered according to the main sources of their ore supply. Some of the Missouri lead is desilverized, but this is not enumerated separately. Many of the refiners treat lead scrap and dross. The amount of refined lead derived from such old material in 1911 was 3916 tons.

PRODUCTION OF LEAD IN 1911
(REFINERY STATISTICS)
(In tons of 2000 lb.)

Class	1910	1911
Domestic:		
Desilverized	217,490	211,041
Antimonial	9,098	8,916
S. E. Missouri	145,387	155,008
S. W. Missouri	20,729	25,993
Totals	392,704	400,958
Foreign:		
Desilverized	90,473	89,487
Antimonial	4,892	4,929
Totals	95,365	94,416
Grand totals	488,069	495,374

Our second table, showing the distribution of lead production according to States, is based upon the reports of crude lead, as returned by the smelters rather than the refiners, except in the case of one interest, which is both smelter and refiner. Allowing for the refined lead obtained from scrap, dross, etc., it appears that while the refiners' production was larger than the smelters' in 1910, it was a little smaller in 1911. The smelters' reports are as near as we can come to the mines. There may, perhaps, have been an even greater increase in the mine production of lead in 1911 than our statistics show, inasmuch as a large quantity of lead ore was accumulated at the Tooele works, whereof the smelting was not begun until 1912.

PRODUCTION OF LEAD IN 1911
(SMELTERS' PRODUCTION)
(In tons of 2000 lb.)

State	1910	1911
Arizona	1,399	4,392
California	1,038	529
Colorado	34,711	28,730
Idaho	99,840	116,524
Kansas	1,343	2,500
Missouri	160,642	173,787
Montana	1,795	2,492
Nevada	2,119	1,076
New Mexico	1,730	1,381
Oklahoma	1,860	1,950
Utah	57,158	54,538
Wisconsin (a)	3,400	3,944
Other States	177	912
Undistributed	1,429	1,760
Zinc Smelters	1,988	3,511
Totals	370,629	398,026

The statistics for 1911 exhibit several interesting features. Among these are the continued growth in the production of Missouri, and the continued decline in that of Colorado, but most surprising is the great jump upward in the output of Idaho. The increase in the lead production accredited to the residues received from the zinc smelters reflects the more extensive use by them of Rocky Mountain ore.

Senator Smoot's Bill

It is encouraging to have the introduction in Congress of a bill abolishing the law of the apex. The wonder is that such a bill was not introduced and passed long ago. The best opinion in the mining industry has been for a long time in favor of discarding the inadequate and troublesome law of the apex and substituting something like the Mexican law. This opinion has been iterated and reiterated by industrial organizations and by the technical press. President Roosevelt appointed a commission to report upon the matter, and knowing the composition of that commission it is not difficult to guess the nature of its report. However, the report was pigeon-holed. We should like to know why? Perhaps Senator Smoot will cause its publication, now that it has been brought to his attention. We should like to have also an explanation of the mysterious, malign influence that has so long delayed this reform.

But much as we desire an improvement in our mining system, we do not like Senator Smoot's bill. It will be foolish to substitute one bad law for another. The reasons why Senator Smoot's proposal is bad are pungently stated by H. V. Win-

chell, in a communication published in this issue. Mr. Winchell is a high authority on this subject, being not only a mining geologist of the highest rank, but also the chairman of the mining-law committee of the Mining and Metallurgical Society of America. We endorse all that he says in his present communication, which we commend to the attention of every one of our readers and to the members of Congress.

Arizona-Morenci Copper Co.

Somebody interested in the Arizona-Morenci Copper Co. evidently believes in giving the investing public two or three bites at its cherry. First brought out as the Copper Mines Co. of Arizona, Ltd., it subsequently became the Arizona-Morenci Copper Co., which was extensively advertised in Great Britain in 1910. In our issue of May 22, 1910, we made some unfavorable remarks about it.

Somebody has lately been advertising in a similar way in the English and Scotch papers. In these last advertisements no one is cited as vouching for the truth of essential statements that are made, as, for example, the assertion that "The Arizona-Morenci Copper Co.'s ground is intersected by the same lodes with the same values as now being worked by the adjoining and surrounding mines." The adjoining and surrounding mines are chiefly those of the Arizona Copper Co., Detroit Copper Co. and Shannon Copper Co. It is not true that in this district there are "some half dozen companies, all of which are highly successful and whose net earnings aggregate more than $10,000,000 annually."

The only honest way to handle such a property as that of the Arizona-Morenci Copper Co. is to organize a development company for the purpose of ascertaining if it contains orebodies of commercial value, not to undertake to delude ignorant people in the present way. The advertisements that have come to our notice are unsigned and evidently inspired by someone who aims to sell stock through the medium of the exchange, the point of the advertising being in the paragraph that "The 7 per cent. participating preference shares of the Arizona-Morenci Copper Co. of $5 (£1) each have a free market on the London stock exchange at about 6s." The company has 1,000,000 of the participating preference shares. In the promotion of two years ago they were offered at 21s. per share. Since then the company has done a little prospecting, but recently even that has not been in evidence.

Australasian Gold Production

The official returns of gold production for all the Australian states have now been collected, except for South Australia, and for that state a close approximation is made. The figures, with those for the Dominion of New Zealand, are given in the accompanying table, in fine ounces. The Northern Territory appears for the first time separately. Heretofore it has been under the administration of South Australia and its production has been included with that state; it is now directly administered by the Commonwealth.

GOLD PRODUCTION OF AUSTRALASIA

In fine ounces

	1910	1911	Changes
West'n Australia	1,470,632	1,370,867 D.	99,765
Victoria	569,644	503,541 D.	66,103
Queensland	441,400	381,845 D.	59,555
New South Wales	188,857	181,121 D.	7,736
Tasmania	37,048	32,992 D.	4,056
South Australia	6,603	5,100 D.	1,503
Northern Ter.	.....	5,600 I.	5,600
Commonwealth	2,714,184	2,481,066 D.	233,118
New Zealand	446,421	411,390 D.	35,031
Total	3,160,605	2,892,456 D.	268,149
Total value	$65,329,705	$59,787,066 D.	$5,542,639

The smallest decrease shown in the table is in New South Wales, where mining and prospecting were fairly active. Queensland lost chiefly on account of some interruptions to mining and milling at Mount Morgan. The loss in New Zealand was due almost entirely to the reduced output from the Waihi mine. In Victoria nearly all the old districts had a diminished production.

The total value of the Australasian gold output for 10 years past is given in the second table.

AUSTRALASIAN GOLD OUTPUT, 10 YEARS

Values

1902	$80,528,316	1907	$75,849,349
1903	89,220,102	1908	73,314,671
1904	87,241,662	1909	70,982,807
1905	85,979,779	1900	65,329,705
1906	82,358,207	1911	59,787,060

The year 1903 was that of maximum production, when the great mines of the Kalgurlie district in Western Australia were at the height of their prosperity. Since then the decline has been continuous, and has been largely due to the decrease in Western Australia, though the other states have shown losses, with few exceptions. The total decrease in 1911, as compared with 1903, was $29,433,036, or 33%. In 1910 and 1911 the losses were almost the same, that in 1910, as compared with 1909, being $5,653,100, or 8%; while 1911 lost $5,542,639, or 8.5%, as compared with the previous year.

Australasia, alone of all the great gold producers, has shown such a continuous decrease. The Transvaal has had heavy gains yearly from the beginning, interrupted only in the two years of the Boer war. The United States and Russia have had occasional small setbacks, but upon the whole have gained largely during the 10 years. Mexico increased its gold production up to last year, when the revolutionary troubles and the unsettled state of the country caused a decrease which, it is to be hoped, will only be temporary. Canada lost in production after the first rush from the Yukon placers was over, as was to be expected; but is showing its ability to recover steadily. The cause of the decrease in Australia seems to be twofold; it is found partly in the diversion of labor to other industries, but more largely in the fact that no new goldfields have been opened and comparatively few new mines in the older districts to take the place of those gradually being depleted. Prospecting seems to be at a low ebb, and there is nothing new in prospect, except in the remote and isolated Northern Territory, the resources of which are still largely unknown.

The simple exposition of colloidal solutions and suspensions in Doctor Jones' article, on p. 800, should be of especial interest to cyanide chemists of the "old" school, and to engineers generally who had only a smattering of the "old" chemistry. Then an atom was the ultimate division of matter and precipitates were precipitates—nothing more nor less. They did not always come down when they were expected, and it was simply assumed that the expected compound was not formed. It was not suspected, at least not taught, that the reason for failure might be that the electrical charge of the colloidal particles prevented them from clotting or precipitating and that this may, under certain conditions, be overcome through the addition of electrolyte. In analysis, we were formerly inclined to look upon the precipitate as the "natural condition of matter" in a solid state in a liquid. The "new" chemistry, however, has demonstrated that colloidal suspension is the normal state, and that the precipitate is in a sense the unnatural condition.

By the Way

"Have you had any experience as an office boy?" inquires an employer in Brooklyn *Life*. "I should say I had, mister; why, I'm a dummy director in three mining companies now."

The *Boston News Bureau* quaintly remarks in a recent issue that "Hayden, Stone & Co. have done all they could to keep the price of Butte & Superior down." While these efforts were being exerted, Butte & Superior rose from $7 to $32 per share. Just supposing Hayden, Stone & Co. had been bulls instead of bears!

"The Stock Exchange has gone wild over Nigerian tin company propositions," reports the London *Economist*. "Fresh concerns have their shares introduced every day. Jobbers haunt a drafty street up till past seven o'clock on raw March evenings; four hundred or more job daily. The public has bought largely."

Bewick, Moreing & Co. seem to have made a very good thing out of Porcuine, their Northern Ontario Exploration Co. having made £81,481 profit out of "the operations at Porcupine and elsewhere since incorporation in January, 1911." Inasmuch as no gold was produced at Porcupine, it is evident that this profit must have been derived from operations in the stock market, especially in the matter of Hollinger shares. The statement is not quite savory.

If one has never heard a Cornish mine-captain direct his men, the following may not be appreciated; it is none the less true, however: It was in a northern Michigan mine that a captain stood on a level calling down to his men: "'Ow meny of 'ee are 'ee d'yyown there?" Promptly came the reply from the attentive men below: "Three, cap'in!" "'Alf of 'ee cum hup 'ere." Thereupon followed an argument as to how the order should be carried out.

In the organization of the Naumkeag Copper Co. by the General Development Co., the majority of the stock fell into the hands of the latter and its associates. This is not at present for sale. More or less stock passed into the hands of other persons as consideration for property turned in. We understand that some of this stock is being offered for sale at $25 per share. It is not considered by the organizers of the company to be worth that. It is figured that the stock stands to them at $7.75 per share, and is fairly rated at $10, the increase representing appreciation in value from consolidating a group of isolated properties. Prospective purchasers of stock that is offered ought to know the opinion of the organizers of the company. They ought to consider also that the company is purely a development enterprise. The property may not contain any payable copper and the money spent in looking for it may be a total loss. This remains to be proved. In the meanwhile nobody should be under any misapprehension.

Our neighbors to the north seem to be acquiring the gentle art of the American superlative. A Gowganda dispatch in an Ontario paper reports that the mine has "a vein which mining engineers have stated to be the biggest in Canada—" After seeing this in cold type, the author concluded he had described too modestly the peerless, awe-inspiring mineralization he had in mind, so the scope of the comparison was increased to exclude everything else "on the continent." Only the thought of the Katanga copper field deterred him from making it the biggest "in the world." However, with the abundance of "geologic formations," the use of the name of a world-famous gold mine, and the clairvoyancy of the examining engineer, the property should manage to pull through. "The vein has been traced for over a mile and runs from two to 16 ft. wide, consisting mainly of quartz, calcite and different irons. . . . The vein runs through all formations, keewatin, slate, granite and diabase. . . . At present a shaft is being sunk in the keewatin and is down 65 ft. now. The vein is gaining a foot in ten, but is still leached. . . . An engineer who inspected the work being done states that at least 25% copper should be obtained when the shaft is down to the water level, which will be about 100 ft. down." The mining engineer who sent us this clipping wrote that he hesitated to think what the production of the porphyry coppers and of the Amalgamated would look like, if this property ever gets to the producing stage.

The Mexican *Herald*, commenting in a recent issue on the present situation, states that it has always been a staunch and outspoken supporter of the constituted government of Mexico. "We do not," it says, "feel that any other policy is proper for foreign residents here and we fully believe that in Mexico, as in any country that elects its executive by popular suffrage, the president should enjoy the support and coöperation of his countrymen to the end of his legal term. We have said this repeatedly in the strongest language we could command. We repeat it today. We can foresee nothing in the overthrow of Mr. Madero but indefinite continuation of trouble. If during the first six months in office of the president of a democracy he be overthrown by revolutionary and dictatorial methods, what hope is there that his successor will not suffer a like fate unless he is strong enough immediately to become the military master of this country? Probably no ruler in history has been obliged to depart more radically and more quickly from the practice of the high ideals of democracy and civil government with which he entered office, than has Mr. Madero. We have been one of those to suffer from the application of the ruthless iron hand that disregards all law in the accomplishment of its purpose. But our own troubles do not blind us to the fact that the forcible overthrow of this administration, the legality of whose election is not questioned, would mark the end of Mexican democracy for a long period, and necessarily set up a dictator whose first arbitrary acts would be the signal for a new movement against him. If American intervention ever comes in Mexico it will only be because conditions in this country have reached such a state that intervention will be asked for by a thousand Mexicans for every American in Mexico who will want it. If intervention ever comes it will be under such circumstances that the vital questions at issue will not be the preservation of the country, the autonomy of the nation, but the safety of the lives and property of native and foreigner alike from a state of anarchy and chaos."

In the JOURNAL of Nov. 16, 1907, p. 931, Floyd W. Parsons called attention to the occurrence of gold and silver in the coal of the Cambria Fuel Co.'s mines in Wyoming. The coal contained from nothing up to $2 in gold when the coal was selling for $1.50 at the mine. The samples from 31 cars of coke showed an average of $2.46 in gold and $0.28 per ton in silver. Assays made by the company's chemist showed $10 per ton in the boiler house ashes and $2 per ton in gold in the sandstone overlying the coal seam. In a recent bulletin, No. 499 of the U. S. Geological Survey, R. W. Stone, commenting on this occurrence, states that there is more gold in the splint and bony coal than in the best bituminous. It may be associated with pyrites, which occurs commonly in the splint and "pine needle" coal. As there are no known dikes or veins within many miles of the coal mine at Cambria, the gold cannot be explained as derived from such a source. That the gold was introduced in the quiet waters of the swamp, either in solution or as very fine particles in suspension, and deposited there by precipitation or by gravity is not impossible nor yet readily conceivable. The most plausible explanation seems to be that the sands which submerged the swamp and now form the roof of the coal bed were derived in part from old gold-bearing alluvium. It was noted above that the sandstone roof carries some gold. Currents which transported the sand and the grit which occurs in some places a few feet above the coal certainly were strong enough to transport fine gold. While the sand was being deposited the gold may have worked down into the underlying bog and is now found in the coal.

Ratio of Copper to Pig-Iron Consumption

By James Douglas*

The high price of copper has excited speculation as to its cause. The following statistics may help to solve the problem. They give the quantity of pig iron and copper consumed in the United States during the 16 years from 1896 to 1911, and the quantity of pig iron and copper consumed by the world during the 15 years from 1896 to 1910. The column of production of iron for this country represents approximately its consumption, inasmuch as the trifling imports of iron and steel are nearly balanced by our exports. The home consumption of copper is taken from "The Mineral Industry" and is calculated on the production, plus importation, minus exports. As larger or smaller quantities are carried in stock from year to year, the following years are bracketed, namely, 1897 and 1898, 1899 and 1900, 1906 and 1907. These couples then correspond approximately with the average and with the consumption of other years. The figures also closely bear out those that I prepared on this subject for the Journal of Apr. 7, 1906, and are confirmed by Brown and Turnbull in their "Century of Copper."

The production of copper shows slighter variations than that of iron, due to the fact that the copper miners, being unprotected by the tariff, have no inducement to restrict their output to the demands of a home market, but have for many years sustained commercial relations with the world at large.

What is peculiarly interesting is the ratio of the consumption of copper to that of iron. During the 16 years covered by the table the consumption of the United States has been one ton of copper to 83 tons of pig iron, whereas during the 15 years illustrated in the table of the world's consumption of copper the ratio has been one ton of copper to 79 tons of iron. So uniform is the proportionate use of the rarer to the baser metal the world over that the ratio of the consumption of copper to iron has never risen above 1:71, nor fallen below 1:86. There have been years of extraordinary divergence from this ratio, but they are rare. For instance, during 1910 the percentage increase of pig iron over 1909 was 7.58%, though the average for 15 years was only 6.03%, while the increase of copper production in 1910 over 1909 was only 1.47%, as against 6.04% for the average. If, therefore, there has been a demand for copper in the ratio of one ton of copper to 79 tons of iron, and if that ratio is to be maintained, the measure of value of copper must be measured by the capacity of the world's copper mines to keep pace with the demand for iron, and the capacity of the world's iron mines to meet that demand. Viewing the world's sources of supplies of rich iron ores compared with the world's scanty sources of supply of correspondingly rich copper ores, the visible supply of iron is in excess of the visible supply of relatively rich copper ores; and therefore a lower grade of copper ore must be steadily drawn upon to supply the world's increasing demand, and this demand, if provided from leaner and still leaner ores, can only be satisfied at what certainly will not be a low price.

*99 John St., New York.

DOMESTIC PRODUCTION AND CONSUMPTION OF IRON AND COPPER, 1896–1911

Year	Pig Iron Produced and Consumed: Long Tons	Pig Iron Produced and Consumed: Per Cent. of Increase	Pig Copper Produced: Long Tons	Pig Copper Produced: Per Cent. of Increase	Per Cent. of Copper to Iron	Tons Pig Iron Produced to One Ton of Copper	Copper Consumed in the U.S., Long Tons	Tons of Pig Iron Consumed to One Ton of Copper
1896..	8,623,127	.....	208,760	.....	2.42	41	102,083	83
1897..	9,652,680	11.94	223,825	7.22	2.32	43	122,501	87 { 78
1898..	11,773,934	21.97	239,241	6.89	2.03	49	122,382	96
1899..	13,620,703	15.68	259,517	8.47	1.91	52	174,822	83 { 78
1900..	13,789,242	1.24	268,229	3.36	1.95	51	155,169	88
1901..	15,878,354	15.15	271,949	1.39	1.71	58	196,836	81
1902..	17,821,307	12.23	288,342	6.03	1.62	62	213,300	84
1903..	18,009,251	1.05	319,043	10.65	1.77	56	224,026	80
1904..	16,497,033	*8.50	372,233	16.35	2.25	44	215,264	77
1905..	22,992,380	39.38	390,733	4.97	1.70	59	273,653	84
1906..	25,307,191	10.07	409,652	4.84	1.62	63	298,472	85
1907..	25,781,361	1.87	392,518	*4.18	1.52	66	240,098	90 { 107
1908..	15,936,018	*38.19	423,302	7.84	2.66	38	218,153	73
1909..	25,795,471	61.86	493,453	16.57	1.99	52	313,905	82
1910..	27,298,545	5.83	484,933	*1.72	1.78	56	339,132	80
1911..	23,647,451	*13.37	491,647	1.38	2.08	48	316,350	75
	292,424,048	9.21	5,537,377	6.01	1.89	53	3,526,146	83

*Decrease.

THE WORLD'S PRODUCTION AND CONSUMPTION OF IRON AND COPPER, 1896–1910

Year	Pig Iron Produced and Consumed: Metric Tons	Pig Iron Produced and Consumed: Per Cent. of Increase	Pig Copper Produced: Metric Tons	Pig Copper Produced: Per Cent. of Increase	Per Cent. of Copper to Iron	Tons Pig Iron Produced to One Ton of Copper	Copper Consumed, Metric Tons	Tons of Pig Iron Consumed to One Ton of Copper
1896..	31,015,302	.....	384,493	.....	1.24	81	384,500	81
1897..	33,513,073	8.05	412,088	7.18	1.23	81	390,081	86
1898..	36,658,272	9.39	440,972	7.01	1.20	83	439,254	83
1899..	40,457,341	10.36	478,200	8.44	1.18	85	467,700	86
1900..	39,599,457	*2.12	499,200	4.39	1.26	79	512,700	77
1901..	40,950,692	3.41	534,800	7.13	1.30	77	494,200	83
1902..	44,342,579	8.28	553,300	3.46	1.25	80	582,500	76
1903..	47,113,730	6.25	591,300	6.87	1.26	80	586,700	80
1904..	46,069,501	*2.22	647,900	9.57	1.41	71	662,400	70
1905..	54,054,783	17.33	693,900	7.10	1.28	78	727,400	74
1906..	59,074,861	9.29	712,900	2.74	1.21	83	722,600	*82
1907..	60,680,014	2.72	703,000	*1.39	1.16	86	657,300	92
1908..	48,640,479	*19.84	744,600	5.91	1.53	65	698,300	70
1909..	61,217,064	25.86	854,100	14.70	1.40	72	782,800	78
1910..	65,860,260	7.58	866,640	1.47	1.32	76	861,000	76
	709,247,408	6.03	9,117,393	6.04	1.29	78	8,969,435	79

*Decrease.

Mining Engineers Organizing in Germany

Our Berlin correspondent informs us that a German society of mining engineers and metallurgists is being formed with the object of furthering close cooperation between the science and the practice of mining. The society aims to be a representative body of mining engineers, to become a center for German mining engineers and to form a link between those at home and abroad. Further information and applications for membership should be directed to the Hill Publishing Co., Berlin, N. W. 7, who will pass them on to the promoters of the society.

New Hydro-electric Plant in Southwest Missouri

A 15,000-hp. hydro-electric power plant is being erected near Forsyth, Mo., on the White River in the Ozark Mountains. The three-phase alternating current generated at this place will be transmitted at 66,000 volts, 43 miles northwest to Springfield, and thence 80 miles west to Joplin. Connection will be made at Joplin with the transmission system of the Empire District Electric Co., which now supplies light and power service to the southwest Missouri lead and zinc mining district. An agreement with the latter company provides for the delivery of surplus power from the Ozark plant when required and the interchange of power during deficiency or interruption in either case. The plant is expected to be completed by Apr. 1, 1913. The General Electric Co., will furnish the electrical equipment.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Senator Smoot's Bill

Senate Bill 6194, entitled "A Bill to amend section 2322 of the revised statutes of the United States relating to mineral locations," was introduced by Senator Smoot on Apr. 5, 1912, read twice and referred to the Senate Committee on Public Lands. This bill reads as follows:

Sec. 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that Section 2322 of the Revised Statutes be, and the same hereby is, amended to read as follows: "Locators of all mining locations heretofore made on any mineral vein, lode or ledge situate on the public domain, their heirs or assigns, shall have the exclusive right of possession and enjoyment of the lands so located and of the veins, lodes, or ledges apexing therein, as permitted by the customs, regulations and laws in force at the date of their locations, but from and after the passage of this act the locators of mining locations upon any mineral vein, lode, or ledge, or of a deposit of mineral or minerals in place, situate on the public domain, their heirs or assigns, shall, subject to such other rights as pertain to claims located prior to the passage of this act, have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations and of such veins, lodes, ledges, and deposits of mineral or minerals in place as lie within the block of ground bounded by vertical planes passing through such surface lines, and no such locator, his heirs, or assigns, shall have the right under such location to follow any vein, lode, ledge, or other deposit outside of the limits of such claim.

"Sec. 2. That notice of location of all mining claims, lode, or placer, made after the date of the passage of this act, must be filed for record with the register and receiver of the land district within which the lands are situated within one year from the date of each location, and unless final entry and payment be made for such claims within seven years after date of location, exclusive of the time covered by pending adverse claims, all rights thereunder shall cease."

It is certain that our mining laws are in need of revision and it is equally certain that the majority of those familiar with the operation of our present system are opposed to the extra-lateral-right principle. It is probable, on the other hand, that no general revision can be accomplished until a more insistent and wide-spread demand forces the serious attention of Congress.

That there is, however, serious danger of the passage of patch-work legislation which will involve the miner and prospector in greater confusion than that under which he now labors, is illustrated by this very bill, S-6194. It might well be called a bill to provide for locating the upper part of veins and depriving the discoverer of the fruits of his discovery beyond his surface boundaries. There are two objections to this bill, which will readily present themselves to the mind of any intelligent reader:

In the first place, it is vague and indefinite as to the character and identity of the "mineral or minerals," for whose location it attempts to provide. Our law has heretofore been all too general on this point, but it has at least specified "valuable" metallic minerals. Under the present act, it might be possible to locate "any mineral vein, lode or ledge, or deposit of mineral or minerals in place" such as salt, phosphate rock, potash rock, or even ledges or dikes carrying precious stones or magnesia or alumina or what not. Of course there should be provision in the law for the working of these and all other mineral substances under some form of possession by the operator; but their nature, comparative value and mode of occurrence should be taken into account and special laws framed accordingly.

The worst defect in the proposed bill lies in its attempt to abolish the extra-lateral-right provisions without at the same time doing away with the requirement for "discovery." Under this bill a prospector might, after discovering a vein, locate a mining claim 600 ft. wide (the maximum width, but only 300 in some States) and thus acquire the title to so much of the vein as lies vertically beneath his surface boundaries. If the vein dips at an angle of 45°, he must stop mining at the maximum depth of 600 ft. (or 300 if he complies with the law in making his location). He cannot locate the land on the dip of his vein until he gets there in some way with underground workings, because he cannot make a discovery. Hence he either loses his vein through the location of the adjacent property by others under some other mineral discovery, or by virtue of some other method of acquiring land, or it must remain unappropriated until he reaches it in the downward pursuit of his vein.

The difficulties certain to arise under such a law require no further description. It is incredible that such legislation could reach final passage without correction, and attention is called to it chiefly because of the example which it affords of the necessity for careful consideration of mining law revision by all who are in any way interested in the future of our mining industry and the development of our remaining mineral resources.

HORACE V. WINCHELL.

Washington, D. C., Apr. 11, 1912.

The Tomahawk Lode

I have no doubt that a large number of the JOURNAL readers are familiar with the fact that E. J. Hulbert discovered the Calumet & Hecla mines. Mr. Hulbert was one of the first explorers in the copper country, and few men knew this district better than he did. There is a story told about Mr. Hulbert and his explorations on the Lakes, which a large number of people believe true, but there are others who question the story.

It runs thus: Mr. Hulbert, after his discovery of the C. & H. conglomerate, continued his exploring and discovered a lode richer in copper than the Calumet & Hecla. This he kept secret for some time. Meanwhile he was making some land deals with a mining company. The mining company in this deal got the best of Mr. Hulbert, and he was so much hurt over the outcome of the deal that he told of the discovery of the lode, which he called the Tomahawk, but said he would never tell the location of it, and left this part of the country, finally going to Rome.

It is generally believed that the Tomahawk lode is a conglomerate, because it is richer than the Calumet & Hecla. The late Fred McKenzie, who was editor of the Calumet *News*, was an intimate friend of Mr. Hulbert, and corresponded with him in Rome. I was well acquainted with Mr. McKenzie. Mr. McKenzie wrote to Mr. Hulbert and told him that if he knew of a rich lode, it was not just the right thing to do to keep it a secret, as in that case it would do him or anyone else no good. Mr. McKenzie sent him my address and asked him to write me a letter and tell me about it, and Mr. Hulbert wrote me a long letter, of which the following is part:

He said he was exploring in this district, that he discovered near the east quarter post of Sec. 2, township 55, range 33, a large rock richer in copper than the Calumet & Hecla conglomerate, but it was not the same kind of rock. This rock at first appeared to be the outcropping of a lode, but in blasting into it it proved to be only float from some other lode as yet undiscovered but evidently a rich one.

Mr. Hulbert's conclusions seem to be that as there was considerable overburden where the rich rock was found, that the lode must be some distance to the west, from which the rich rock was broken, as the appearance here is that in the glacial age all the floats were carried to the east. There is one thing in connection with this Tomahawk lode worthy of note. By consulting the map of this district, it will be noticed that the Hulbert float was on the line of the outcropping of the lode from which a rich diamond-drill core was taken a few months ago, from hole No. 16, on the Mayflower property, in Sec. 8, township 56, range 32. The rich rock was found about one-quarter of a mile east of the Oneco property.

JOSEPH HOSKING.

Osceola, Mich., Mar. 28, 1912.

The College Man Underground

There was a time within my memory when the notion was prevalent among the mining men of Colorado that underground was quite the proper place for the college man, but the idea was vested with a sinister significance. But in these later days, the old-time prejudices are giving way before the fact that the college man is no longer oblivious to the value of a knowledge of the smaller practical details, but is working determinedly with the intention of getting more intimately in touch with them.

In those early days the impractical "book miner" and his imperfectly understood "theories" were the subjects of profane and unpublishable comments on the part of "practical" men, who had sledged their way up from the ranks. That many "practical" men had attained positions of importance, from which vantage points they could, if they chose, employ college men was sufficient evidence for the mining men to convince them that a college education, so far as mining was concerned, was of little or no value, and that the time spent in getting it was little better than wasted. But time and better acquaintance are bringing the two together. The college man is appreciating more fully than ever before the value of first-hand knowledge of the smaller practical details of his chosen profession and the "practical" man is daily facing problems the only solutions of which are to be found in a broader and deeper knowledge of the basic principles; access to which has, in large measure, been denied him by the necessarily narrow scope of his operations.

But in taking his course in the college of hard knocks, the practical man has more or less consciously developed the commercial sense. In this the college man is sadly deficient. His college training, insofar as its money getting features may be considered, makes him a salary seeker. He meditates on a better job at a higher salary. The practical man, who not infrequently pays the salary, may well be imagined as saying to himself in his complacent moments: "Well, I didn't need to go to college after all. There are plenty who did it for me."

The college course cannot impart a knowledge of the practical details, neither does it develop the business sense, which leads to the idea that the college man might well work underground until he can lay aside from his wages enough to keep him in "grub" while he develops a prospect or works a lease "on his own hook." If he should find it necessary to go out among the moneyed men to promote his proposition, he would find opened up before him a broad field filled with educational opportunities. Though this field has been discredited by its having been the stamping ground of fakirs and charlatans, it is none the less legitimate. His operations in this field would not only broaden immensely his understanding of the business of mining in its ramifications, but would generate within him a spirit of independence and self-reliance that has its spiritual and money value. Such a course might land him in the president's chair of a prosperous mining company, instead of halting him half way at the desk of the superintendent.

R. D. O. JOHNSON.

Medellin, Colombia, Mar. 28, 1912.

Atomizing Metals

The recent advertisements of the atomized-metal makers recall the expedient by which a friend of mine used to make test lead about a dozen years ago. The lead was melted in a small kettle and poured by hand into an iron amalgam retort; in the bottom of the retort a hole was bored, into which any one of a number of small nipples could be screwed. These nipples were pierced with holes varying from $\frac{1}{32}$ to $\frac{1}{16}$ in. in diameter. The lead flowed through the hole and was allowed to fall freely through the air. A little below the exit was a flattened pipe which delivered a blast of air at a pressure of 2 lb. per sq.in. against it. This jet was inclined slightly downward.

The flowing stream was immediately disrupted and blown off to one side. The lead as it fell formed a more or less solid cake, which, however, broke up when placed on a sieve. If the air blast were cold, the lead particles were beautifully white and free from oxide, and could be molded by simple hand pressure into "snowballs." I once saw a number of samples of his product, the particles of which appeared to be about 60 mesh.

He told me that he once sent a sample to a test-lead manufacturer asking for bids on a similar grade of material, and received the answer, "We cannot afford to polish each grain by hand, considering the present price of test lead." The manufacture was given up by him when the manufacturers eventually improved the grade of their lead.

THOMAS MCKITTRICK.

New York, Apr. 11, 1912.

The Steel Used in Drilling

Much has been written pertaining to the results achieved by drills of modern design. Little, however, has been published in regard to the steel of which the drills bits are made. The time has now come when any further increase of drill power must be attended by the use of stronger and better steel, for even some of the machines now in use strike so hard a blow that trouble is frequently experienced from the bending of the best grades of high-carbon drill steels, or under the shower of rapid blows of the air-hammer drill the phenomenon called "crystallization" causes annoyance through the breaking of cutting edges and shanks of the bit.

There has been a tendency even among the contractors to dispense with use of large steel, and inch or $1\frac{1}{4}$-in. steel is now the standard in most drilling work. The hollow steels, particularly the round section, are gaining favor, and their adoption is rapidly extending. The star or cross-section is highly esteemed in the West, because of the greater clearance afforded for the ejection of cuttings.

The air-hammer drill has been a stimulus to steel manufacturers to produce a higher quality of material, and some are now investigating the merits of alloy steels. One company has already placed a vanadium steel on the market and a Western company has given an order for a consignment of chrome steel for experimenting with drill bits of that material. It is a growing opinion that these alloy steels will ultimately be proven not only to be superior to ordinary drill steel, but absolutely necessary if more powerful machines are built. At present, however, alloy steels for drill bits have not been proven to be better than the best American and Swedish drill steels.

DRILL SHARPENER.

Victor, Colo., Apr. 6, 1912.

Byproduct Coke Ovens

On p. 497 of the JOURNAL of March 9, 1912, is given a list of byproduct coke ovens operating in the United States, as of Jan. 1, 1910. The following additions will bring it up to Jan. 1, 1911 (cf. *Journ. Ind. and Eng. Chem.*, March, 1912). *Koppers*: Woodward Iron Co., Woodward, Ala.; Tenn. C. I. & R.R. Co., Corey, Ala. *Rothberg:* Cleveland Furnace Co., Cleveland, O.; Lackawanna Iron & Steel Co., Lebanon, Penn. *Didier:* Lehigh Coke Co., South Bethlehem, Penn.

H. J. MARTIN.

New York, Mar. 23, 1912.

North Star Annual Report

A summary of the results of operations for the year ended Dec. 31, 1911, at the property of the North Star Mines Co., at Grass Valley, Calif., is given in the accompanying financial statement, which has been prepared from data given in the annual report recently issued. The most striking difference between the years 1910 and 1911 is the lower yield from the ore milled; $13.683 for 1910, as compared with $10.745 for 1911. The difference was due in part to more systematic working of the stopes throughout the mine, without effort to mine the richer ore exclusively. The operating costs for 1911 were 27c. per ton less than for 1910, and this reduction was accomplished in spite of more care being taken in sorting

NORTH STAR FINANCIAL STATEMENT, 1911

Receipts

Balance on hand, Jan. 1, 1911..		$1,045,514
North Star mine production, 98,400 tons, less 2999 tons sorted out, leaving 95,401 tons of ore milled containing $10.985 per ton:		
Yield by amalgamation	$790,300	
Yield by cyaniding concentrate	71,561	
Yield by cyaniding tailing	163,226	
Loss in tailing.....	23,000	
Total gold in ore..	$1,048,087	
Total gold recovered, $10.745 per ton		1,025,087
Interest and dividends received		42,273
Total		$2,112,874

Disbursements

Operating expenses:	Per ton milled	Total
Mining	$3.317	$316,438
Milling	0.526	50,220
Concentrating	0.138	13,155
Cyaniding	0.541	51,571
Bullion	0.031	2,922
Miscellaneous	0.311	29,713
General	0.163	15,557
Taxes	0.282	26,928
Accident and benefit	0.064	6,129
Total	$5.373	$512,633
Less sundry receipts	0.028	2,708
Total operating expense	$5.345	$509,925
Development	0.487	46,481
Total operating and development	$5.832	$556,406
Cincinnati Hill development		46,445
Property purchases		11,620
Champion mines option.....		154,701
Dividends, 27-30, 17%.....		425,000
Balance, Dec. 31, 1911.....		918,702
Total		$2,112,874

out waste in the mine and on the surface, which, of course, reduces the tonnage per unit of vein area worked. The cost of development work was also reduced 7c. per ton, so that the total cost for operation and development was 34c. less for 1911 than for the previous year.

In the annual report for 1910 it was indicated that a small quantity of ore remained available in the upper workings, or above the 2700-ft. level. This ore, amounting to 7450 tons, was mined early in 1911, and the resources of the upper mine are now exhausted and work has been discontinued there. All the workings below the 2700-ft. level are operated through the Central vertical shaft. The ore mined below the 2700-ft. level was broken chiefly in the stopes at the 3000-, 3400- and 3700-ft. levels; the quantity was 90,590 tons, from which 2999 tons of waste was sorted.

Development work in extending drifts and raises was done between the 3000- and 5300-ft. levels. Ore of fair grade was found at the 5300 or lowest level, indicating the continuance in depth of profitable ore. It is not possible to make any precise statement of the ore reserves, as the vein is so irregular in size and so erratic in its tenor of gold, but it may be said that the new ground opened is likely to yield a supply of ore equal to that extracted during the year and developments indicate that the present scale of operations can be maintained for several years to come.

The results of exploration work on the Cincinnati Hill claim were disappointing, and as further work does not seem to be justified, it must presently be abandoned.

Early in 1911, the company obtained an option on the Champion group of mines, situated at Nevada City, about six miles from Grass Valley. This property comprises a number of mines and claims, some of which have been large producers in the past, and covers an extensive area of promising ground. An examination was made and some preliminary work undertaken, but it was found that there was no possibility of reaching any reasonable conclusion as to the value of the property within the time specified in the option, which was accordingly surrendered. Subsequent negotiations resulted in the taking of a new option, effective until July 2, 1913, under which active operations were carried on during the last six months of 1911. Much work has been done in cleaning out and retimbering old levels, repairing and retimbering shafts, installing new pumps and other machinery, and generally in bringing the property to a condition now about reached where actual opening of the ground can be undertaken. Development and exploration work will be vigorously carried on during the coming year in the hope that enough will be accomplished to justify an estimate of the value of the property, which will enable the company to decide whether to exercise or abandon its option. The reopening of this group of mines, practically abandoned and with many of the workings filled with water, was warranted, in the opinion of the directors, by the history of the district and by the geological conditions, which seem to indicate that the veins continue in depth; and the directors have accordingly felt justified in providing the necessary funds from the accumulated surplus of the company, believing that an opportunity is offered of acquiring at a moderate price a property for which, if developed and operated under economical conditions, a prosperous future may reasonably be expected.

Mining Affairs in Germany

JENA CORRESPONDENCE

The all absorbing topics in Germany's financial and mining circles during the last month or two have been the dissensions in the board of the Hohenlohe Werke Aktien-Gesellschaft, which reached their climax in the resignation of two directors and the dismissal of the managing director, and the coal miners' strike in the Ruhr district, which ended in a fiasco.

DISSENSION IN HOHENLOHE COMPANY

The Hohenlohe Werke A. G., commonly though incorrectly referred to as the "Princes' Trust," is an Upper Silesian concern, which owns extensive coal fields, part of which are developed, zinc mines and reduction works. The majority of the stock is owned by Prince Hohenlohe, a wealthy landed proprietor; the minority interests are represented by the Deutsche Bank, which had two seats on the board. The managing director, having incurred the wrath of the prince by some disastrous investments in Norwegian ore and in German potash mines, by opposing the plan of opening up the coal fields of Gleiwitz and by extravagances committed in improving the grounds of the general manager's residence, an investigation was ordered of the internal affairs of the management, and was made by chartered accountants of the Deutsche Treuhandgesellschaft (guaranty trust company), of Berlin. Thereupon the two directors representing the Deutsche Bank resigned from the board in evidence of their disapproval of what they considered unwarrantable proceedings.

They claimed that the above mentioned investments were ventures sanctioned by the full board, that by opening the coal fields of Gleiwitz at the present time the Upper Silesian market, which is already overstocked, would be deluged and the valuable coking coal of the Gleiwitz field would have to be sold at a sacrifice. The expenditure of 1,200,000 m. for improvements upon castle Michalkowitz, the general manager's residence, and its park, distributed over a space of six years, was not considered extravagant. Meanwhile the chartered accountants went through their work and found nothing disparaging to the management. Nevertheless, Managing Director Lob was removed from his position, and Mr. Trippe appointed to take his place. Despite all this unpleasantness the Deutsche Bank is continuing its business relations with the prince's concern by underwriting 40,000,000 m. of bonds for it, secured by a mortgage on the Hohenlohe mines and works.

STRIKE OF COAL MINERS

Following this sensation came the coal miners' strike, which was foreshadowed months ago, but did not take shape until

after the British miners' strike was in full swing. The most conspicuous place of operation was the Ruhr district, where about 370,000 men are employed at the mines. The employees of the mines are compelled by law to join the *Knappschaft,* a mutual-aid society which affords relief to the sick, invalids, widows and orphans from a fund that is maintained through fixed contributions from the mine workers and the employers, the latter having to pay at least one half of the former's quota. All fines and dockings likewise flow into this fund, which is administered by a board of managers selected in equal numbers by employees and employers. The board of managers is under the surveillance of a government council.

By virtue of the right of coalition the mine workers have, however, organized besides separate trade unions for the promotion of their special interests in regard to wages, time of work and kind of work and for accumulating and maintaining a strike fund. In the Ruhr district there are quite a number of these unions. The five more prominent ones in numbers of members are the following: (1) The social democratic, or "old" miners' union; (2) the Hirsch-Duncker miners' union; (3) the Polish miners' union; (4) the Christian miners' union; (5) the "yellow" miners' union. As its name implies, politics plays an important part in the organization of the social democratic union, and it is the most grasping and restive of all. Nos. 2 and 3 pay less attention to politics than to their own particular interests. No. 4 is influenced to some degree by its religious advisers. No. 5 is, on the whole, loyal to its employers. It derives its name from the yellow color of its member cards.

Operators Offer 10% Increase

It was rumored that in consideration of the rise in the price of coal and the growing dearth of the commodities of life, the coal operators would raise the wages of their employees about Apr. 1 by 10%. This did not satisfy the social democrats; they clubbed together with the Hirsch-Duncker and the Polish unions, the others declining to join, and presented a list of 10 demands to the operators through their leaders, foremost of which was a demand for an increase of 15% in wages and a reduction of working time from 8½ to 8 hours.

The operators declined to arbitrate with other than the workmen's committees from their own mines, and so the strike was proclaimed on Mar. 10, when a vote was taken at a convention of delegates from the different mines assembled at Herne, Westphalia, an overwhelming majority pronouncing in favor of the strike. Needless to say incendiary speeches *à la* Dennis Kearney were made by agitators to stir up the feelings of the wavering ones. On Monday, Mar. 11, about 58% of the workmen did not go to work.

In the meanwhile the government had quietly distributed 6000 state police over the most populous parts of the district to prevent outrages and protect the men willing to work. When, however, riots broke out in several places and it was feared that the police would not suffice to keep order, a military demonstration was made by the government by sending a few regiments of infantry and some squadrons of cavalry to Dortmund, a good distributing point for troops. This had a good effect.

The number of strikers fell off from day to day and, finally, when the operators gave notice that those who did not return to work within three days would lose their jobs, there was a general stampede from the ranks of the strikers. When the leaders saw their game would be lost, they called another meeting of delegates to Bochum for Mar. 19, and advised their followers to return to work. A vote was taken upon this proposition and a majority of the delegates, although not a large one, concluded to give in. So the strike was declared off, and on Mar. 20 most of the strikers reported for work.

Strike Lasted Only Nine Days

The strike had lasted just nine days, and benefited, if anyone, the operators only, for they were able to dispose of their old and deteriorated stock at enhanced prices. None of the iron works had to be shut down on account of the strike. Upper Silesia would have been able to reconquer most of its ground lost to the British, if the government had had the foresight to provide for cars to move coal and coke at a livelier rate. But, as usual, there was a great shortage. This is an argument against state ownership of railroads.

The strike fever crept slowly all over the coal districts of Germany, only in a minor degree, and did not affect the lignite districts. It is now dying out fast. In Bohemia the coal miners do not seem to have come to rest yet. As far back as Mar. 9 the two miners' unions, the Czech national and the Czech anarchist, had a meeting at Brünn, at which it was resolved to send three delegates to each pit and present the following demands to the managers: (1) Establishment of a minimum wage of 5 kronen ($1.06) per shift; (2) revision of the tributes; (3) 8-hour shifts. No settlement has been reached yet and most of the mines are idle.

Explorations in the Trans-Baikal province in Siberia have shown several large deposits of tungsten ore, but none of them has yet been worked.

Appraising Mines

The following remarks of J. R. Finlay, delivered before the Harvard Engineering Society of New York[1], are of particular interest in connection with his appraisal of Michigan iron and copper mines, published in the JOURNAL some months ago.[2] Mr. Finlay said in part:

My appraisal of the copper mines met, I think, little opposition in Michigan, but in the East it raised quite a storm of dismay and disapproval because it was too low. I had the pleasure, therefore, of finding myself denounced as a bear and a bull at the same time. The work had been pursued on a logical basis, and, if it was right in one case, it was right in the other. If it was wrong in one case, it must be wrong in the other, and for the same reason. It was extraordinary to please nobody. Independent and disinterested engineers were good enough to show a marked approval of the work. It was perfectly evident that the attacks of the appraisal came from two sources and were dictated by two opposite points of view.

The Point of View

The copper valuations were thought to be too low by men who were interested in the stocks and had little or no interest in taxes. The iron valuations were thought to be too high by men who had no interest in stocks, but who were highly interested in taxes. The iron men worship only one god; his name is not Mammon, but "Cost Per Ton."

The difference in the point of view is sufficient to explain the vast difference in the valuations that had ruled in the two groups of properties. The stock owner and speculator lives on an exaggeration of hopes; the plain mine operator is oppressed by an accumulation of fears. He has to face, unsupported, the dangers and uncertainties of the mysterious underground, and he has to warn his owner or associate constantly against entertaining hopes that may not be realized. The stock seller profits by an irresponsible optimism to support which he has to flout as pessimism what is really common sense. The plain miner clings to the conditions of the moment, sees little except his ever present difficulties and denounces as visionary the man who tries to take a bird's-eye view, reducing his ups and downs to the plane of averages, or who values his plant at more than it cost.

Mining Stocks Generally Quoted Too High

That mining stocks are generally quoted at too high prices is generally known to, and deplored by, mining engineers. It is so well known that most men in the busi-

[1]Harvard Engineering Journal, January, 1912.

[2]Eng. and Min. Journ., Sept. 9, 16, 23, 30, and Oct. 14, 1911.

ness feel that to buy mining shares is not a serious investment in property, but a speculation in human nature. I am not speaking of the innumerable wild cats that are palmed off on the ignorant, but the great dividend-paying stocks. I can prove this by a few facts that anyone can understand.

In 1910, twenty-one leading copper companies produced 1,045,000,000 lb. of copper. Calculating their average price as a mean between high and low quotations for the year, their average value was $754,000,000. The dividends paid were $35,800,000, equal to 4.76 per cent.

In the same year, 21 leading railroad stocks, calculated in the same way, showed a dividend of 4.96 per cent.

Fearing that 1910 might be an off year for the copper business, I looked up the record of the same mines for a period of five years ending with 1910. During those years copper averaged over 15c. per lb. The average dividend on the average selling price was 5.19 per cent.

Mining an Exhaustive Enterprise

These facts are so easily understood as scarcely to require comment. It is perfectly evident that the copper shares are too high. The railroad dividends are a real profit on a stable investment. The mining dividends are a return of capital as well as interest. The railroads are a better property year by year, the copper mines are sure to play out. No amount of iteration can add much to the force of these plain facts. This great mass of property is yielding to the investor only the interest that he can get on a thoroughly secured bond or mortgage. It is doing nothing whatever to return the principal. The true logic of the situation is that the dividends of these copper mines, instead of being a gain of $35,000,000 a year are to the actual investor a loss of $35,000,000 a year, for the public must be prepared sooner or later to lose the purchase price in a lump at the date when each mine will be exhausted, or it must, in order to make good the principal, forego the enjoyment of the interest which it should properly be able to spend; for it is plain to make good the principal on these investments the whole dividend will have to be put into a sinking fund. Whether such a sinking fund could be made to cover the purchase prices by the time of the exhaustion of the mines, is itself a doubtful proposition.

Modern Methods Hasten Exhaustion

The salient fact about the mining business is that it involves the rather rapid exhaustion of individual deposits and groups of deposits. The increasing efficiency of modern methods introduces economy very largely by increasing the speed of the operations and diminishing instead of increasing the life of the mines. Advancing knowledge of the geology of ore deposits and more comprehensive methods of exploring and finding them, while largely preventing the stoppage of operations through mere failure to find the ore, really hasten and make more thorough and certain the final exhaustion of each unit. The function of science in prolonging the life of the mining business really lies in widening the field in which fresh deposits are found.

All these observations are, to the mining engineer, so trite as to be threadbare. I am sure that most of you are fully aware of the truth of them. You do not need to be told that the dividend on a mining stock should be more than the interest on a bond, or the dividend on the stock of a growing railroad. What I think you do not know and the public does not know is the fact that the average dividend of good copper mines makes such a low return on the average price. I did not know it myself until I recently looked it up. It comes in very handy, however, as an illustration of how utterly impossible it would be for any sane engineer to make a serious report on the valuation of copper mines which would not be disappointing to the average stockholder.

Effect of Over-popularity

You will observe that I am speaking in general terms and using the average of a number of properties. I am not attacking anybody. Nothing could be more absurd than to expect the owner of shares to sell them for less than he could get for them. It is probable that this kind of investment is suffering from over-popularity, just as other kinds of enterprises have in innumerable cases.

It is probable that copper shares are more overvalued than other mining stocks just at present, because they are popular; but this is recent and may not last long. It is only within the last 10 years that speculation in copper stocks has become widespread.

In other mining stocks, the public seems to have better appreciation of the realities. The Treadwell group of mines are probably as long-lived as any, or almost any, of the copper mines, but the shares have sold at prices which gave a dividend return of 13%; many of the Cripple Creek gold mines yield from 12 to 20%; the Homestake shares about 7%, and Goldfield Consolidated over 30 per cent.

It is generally supposed in this country that gold mining is a much more risky and generally less productive venture than copper mining. This idea has some foundation, so far as the United States is concerned, but as a general proposition it is a great mistake. The value of the annual gold production of the world is fully twice that of copper; the margin of profit is quite as large and the life of the mines fully as well assured. There have been times when gold mining has taken the form of a craze, but the present is not one of those times.

William A. Lathrop

William A. Lathrop, president of the Lehigh Coal & Navigation Co., and the Lehigh & New England R.R., one of the foremost men in American coal-mining circles, died Friday, Apr. 12, at the City Hospital, Wilkes-Barre, Penn., following an operation for appendicitis. His condition had been critical for several days, and a number of specialists had been summoned to his bedside.

Mr. Lathrop was 58 years old. He was born in Springville, Susquehanna County, Penn., and acquired his earlier education at the schools of that town. Later he entered Lehigh University, and in 1875 was graduated with honors as a civil engineer. He afterward took a course in mining and received his degree of mining engineer from the same institution. For two or three years after his graduation, he was employed in various minor capacities, both in the anthracite mines and on railroad work in the Wyoming and Lehigh districts of Pennsylvania. Mr. Lathrop subsequently became assistant to Robert H. Sayre, chief engineer of the Lehigh Valley, and filled this position with great credit for several years. He was later associated with Major Irving A. Stearns, of Wilkes-Barre, and for a time took over the management of an iron-mining enterprise in northern New Jersey.

In 1881, when the Southwest Virginia Coal Co. required a superintendent and mining engineer to open up its prospects in southwestern Virginia, Mr. Lathrop was selected for the position. He started the mines which have since become the center of the Pocahontas field, and incidentally laid out and built the present town of Pocahontas.

After several years of labor under great difficulties in this pioneer work in Virginia, he returned to Pennsylvania to take charge of the bituminous mines of the Lehigh Valley Coal Co. at Snowshoe, in Center County; in 1888 he was made superintendent and general manager of all the Lehigh Valley mining operations, succeeding the late Frederick Mercur. Mr. Lathrop remained at Wilkes-Barre in this capacity until 1902, when he resigned to take the presidency of the Webster Coal & Coke Co., operating in central Pennsylvania, and later was made president of the Pennsylvania Coal & Coke Co. When that company leased its mines and lands to other interests, he became president of the Lehigh Coal & Navigation Co., with headquarters in Philadelphia, succeeding Lewis A. Riley. To his constructive

Note—Abstract from "Coal Age."

ability, foresight and perception of the necessities of the future are largely due the many improvements which the "Old Company" has already carried out and still has under construction, including the Panther Creek drainage tunnel, the direct railroad connection with the Lehigh & New England R.R. and the erection of a great central power plant, which has just been begun.

Mr. Lathrop was a member of the State Commission appointed by Governor Tener a few months ago to devise a plan for the protection of the surface of the anthracite region from damage by mine caves. He was a trustee of Lehigh University, president of several coal companies, a director of the People's Bank, of Wilkes-Barre, and of the Fourth National Bank, of Philadelphia, a member of the American Institute of Mining Engineers, the Mining and Metallurgical Society, the Union League, University, Art and Downtown clubs, of Philadelphia, the Westmoreland Club, of Wilkes-Barre, and the Pennsylvania Society of Sons of the Revolution. Although, in recent years, much of his time was spent in Philadelphia, Mr. Lathrop made his home at Dorranceton, near Wilkes-Barre. He leaves a widow and one daughter.

Production of Fullers Earth in Florida

The production of fullers earth in Florida in 1911 was about 25,000 tons; in 1910 Florida produced 18,832 of the 32,822 tons of fullers earth mined in the United States, according to a recent report by E. H. Sellards of the Florida Geological Survey.

The Southern Fullers Earth Co. and the Owl Commercial Co. were combined during 1910, and reorganized under the name of the Floridin Co. During 1911 this company continued the operation of two plants in Gadsden County, one at Quincy, and one at Jamieson. A new plant, that of The Fullers Earth Co., began operating in 1911 at Midway, in Gadsden County. In Manatee County the Atlantic Refining Co. mined, as in former years, at Ellenton. The Florida Fullers Earth Co., also near Ellenton, operated during a part of the year.

German 1911 Potash Exportation

There were exported in 1911 from Germany 11,549,730 metric quintals of raw potash salts such as kainite, kieserite, etc., valued at $7,601,720. Of this quantity 6,425,734 quintals went to the United States. Potassium sulphate was exported to the extent of 1,095,548 quintals, valued at $4,462,500; of this quantity 569,695 quintals went to the United States. The amount of potassium-magnesium sulphate exported was 2,825,742 quintals valued at $4,764,760; of this quantity 1,437,746 quintals went to the United States. Potassium chloride exported amounted to 3,297,342 quintals, valued at $11,735,780; of which 2,292,398 quintals went to the United States. On Mar. 1, 1912, there were 97 works in the potash syndicate.

The Steel Corporation and Labor

At the annual meeting of the United States Steel Corporation, on Apr. 15, the eight members of the board whose terms expired were reëlected for three years: Henry C. Frick, William H. Moore, Norman B. Ream, James H. Reed, Percival Roberts, Jr., Charles Steele, Peter A. B. Widener, and Robert Winsor. The routine proceedings at the meeting presented nothing special.

Steel Labor Conditions

The interest of the meeting centered in the report of the Committee on Labor Conditions, which was appointed last year on motion of Charles M. Cabot, of Boston, who has since been active in various ways in investigating and discussing the labor question. The committee was headed by Stuyvesant Fish, and had prepared an elaborate report.

Immediately after the reading of the annual report for the year, Chairman Gary took up the vexatious question of labor conditions. He supplied the stockholders at the meeting with a pamphlet containing replies to a circular letter, and a booklet describing the result of an investigation of hours of labor in the steel industry, made by John A. Fitch, of the Pittsburg Survey, at Mr. Cabot's request, and sent by him to 15,000 stockholders.

Judge Gary said that only 92 replies had come in from the list of 15,000 addressed, and of these only 13 were in favor of an eight-hour day. Most of this number, he added, came from clergymen and women. In further explanation of the attitude of the Steel Corporation, Judge Gary gave out copies of a circular letter sent to stockholders on Mar. 12, which briefly set forth Mr. Cabot's contentions and explained what the Steel Corporation has endeavored to do in the amelioration of labor conditions.

The report took up the labor problems under four heads, the "seven-day week and long turn," the "twelve-hour day," the "speeding of the workman," and the "repression of the men." This report condemns the seven-day week and the twelve-hour day, and makes suggestions for reductions in hours from these extreme limits wherever possible. Of the speeding of the workman, however, the report fails to find any abuse of the bonus or piece-payment system, and, in fact, praises this means of effecting *esprit de corps* in high terms.

The committee seemed somewhat in doubt as to what is meant by "repression of the men," and says:

"If it involves the question as to what measures the officers of the Corporation should adopt for the suppression of organizations that in the past have, at times, proved irresponsible and incapable of self-control, that have advocated and oftimes insisted upon what are believed by many to be fallacious theories and practices, then, at least, the charge may well be open to discussion.

"As a committee of stockholders we do not believe the final solution of the problems involved in this question has been reached. We do believe the present methods are preferable to the old for all concerned, and that the Steel Corporation, in view of the practices often pursued by labor organizations in steel mills in past years, is justified in the position it has taken.

"That the method of employment of today must prove to be the best for the future is a question on which there may well be a difference of opinion. The interests of society and the community at large will not best be served by that type of mind, whether it be employer or employee, which bases action on the assumption that might makes right. On the contrary, the adjustment of the relations between employer and employee is a task for men of sound minds, reciprocal natures, broad sympathies and courage, men who believe that the future may be made better than the present. May it not be reasonably hoped that such men, whether they be officials or wage earners, may more and more be found working together to bring forward the day when employer and employee shall enter into a common administration of industrial interests?"

The reading of the report was followed by a sharp discussion. It was attacked by Mr. Cabot and defended by Mr. Fish, and there was some sharp personal discussion between Mr. Cabot and Judge Gary. A strong plea was made for a further investigation, but no action was taken.

Apparently this ends the matter, so far as official action by the Corporation is concerned. There is little doubt, however, that there will be further agitation on the part of Mr. Cabot and those who are associated with him.

A special meeting of the stockholders of the Guggenheim Exploration Co. is to be held on Apr. 17 to vote on reducing the par value of the stock from $100 to $25 per share. The company is capitalized for $22,000,000, and four shares of new stock will be exchanged for one share of old. It is said that the company will apply for listing on the New York Stock Exchange. The stock has recently been selling at about $225 on the curb market.

Details of Practical Mining

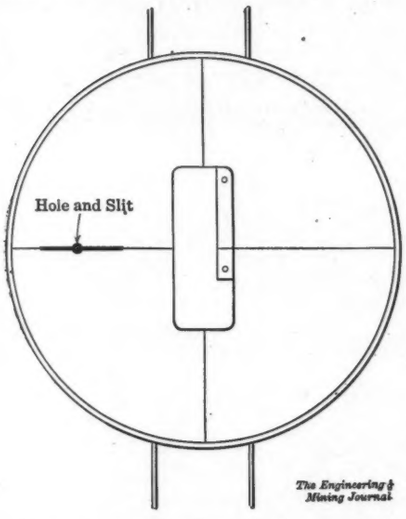
Accounts of Useful Ways of Doing Many Things in the Day's Work

Target for Mine Surveying

By WALTER R. HODGE*

To the transitman who has need for a target underground, the rig shown in the accompanying sketch may be of interest. It is used in some of the mines of the Mesabi Range and I believe originated there.

A hole 0.05-in. diameter is bored in the target on the sides opposite the thumb-screw, midway between the center and edge of the target. Extending on either side of the hole for ¾ in. is a slit of a V-shaped section, the narrow end of the section cutting the front surface of the target. In practice a candle



TARGET FOR UNDERGROUND SURVEYING

or lamp is held behind the target so that the level line shows as a narrow bar of light by which the target may be set accurately.

Shaft Water Used to Drive Fan

At the Bowhill colliery in Scotland, the problem of ventilating one of the lowest seams was solved in an ingenious manner by utilizing the water that drained into the upper part of the shaft to drive a Pelton wheel connected with a Sirocco fan.

The mine, in common with many others in the district, was operated through a wet, downcast shaft, the water from which formerly drained into a sump at the bottom and was pumped to the surface. The lining of the shaft was cut and a collecting ring provided to divert the water into a tank which was installed in a room cut in the wall of the shaft for the purpose.

The ring and tank were 295 ft. above the bottom of the shaft. A 4½-ft. Pelton wheel was installed at the level of the lowest seam and was driven by the water collected in the tank in the shaft and conducted to the wheel through a suitable pipe.

The Pelton wheel drove a Sirocco fan of the double inlet type, 5 ft. in diameter, capable of delivering from 60,000 to 90,000 cu.ft. of air at a water-gage pressure of one to three inches. In order to stop the fan a bypass valve was provided by which the water could be diverted from the Pelton wheel and discharged directly through the pipe leading from the shaft tank to the sump to which the main mine pumps were connected.

Preventing Freezing of Air Exhaust

Alcohol is used to prevent freezing at the exhaust of the air-operated shot drills in use at the site of the new station in New York of the N. Y. C. & H. R. R.R. The New York Central railroad has had occasion to do an enormous amount of core drilling within the last 15 years, and in this work several types of drills have been used. One of the most interesting outcomes of the work is the freezing-prevention appliance that can be readily adapted for use on any small air-operated machine where trouble is experienced from freezing at the exhaust.

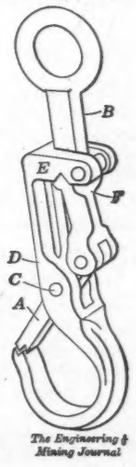
Alcohol is admitted to a vertical part of the air-supply pipe and close to the machine. The device used for feeding the alcohol is attached to the feed pipe as is a lubricator. It consists of a piece of 1½-in. pipe about 12 in. long, fitted with bushings at the top to take a piece of ½-in. pipe six inches long. The small pipe is closed by a valve. The other end of the 1½-in. pipe is fitted with bushings to take a 3-in. piece of ½-in. pipe, to which a valve and an elbow are attached and into the elbow another short piece of ½-in. pipe is screwed. The threaded end of the last-mentioned pipe is screwed into a hole tapped into the air pipe so that when screwed tight the 1½-in. pipe is parallel to the air pipe.

By opening the top valve, the 1½-in. pipe can be filled with alcohol. That valve is then closed, and, when the machine is operating, the lower valve is opened just enough to permit drops to pass slowly. The admixture of alcohol vapor in the air effectually prevents freezing at the exhaust. The 1½-in. pipe, which has a capacity of about one pint, is usually filled with alcohol twice per shift.

A Safety Hook for Hoists

A patent was recently granted in Great Britain for the safety hook shown in the accompanying sketch, the operation of which is apparent. The opening of the hook is closed by the simple lever *A*, one end of which is attached to the sliding member *B* as shown.

When the rope is slack the sliding member slips to its low position opening



A SELF LOCKING HOIST HOOK

the hook by raising the end of the lever *A*. Upon taking up the slack of the hoisting rope, the hook opening is closed by the lever. The pull of the rope does not come on the pin *C*, but upon the part *E* of the body of the hook *D*, a projection *F* of the sliding member engaging the part *E* of the body.

The angle of inclination, in stoping by the shrinkage method, should be such that the broken ore will run freely when drawn off; otherwise removal of the ore will be difficult, and hence costly, as it is often impossible to enter the opening after a large amount of ore has been withdrawn.

*Mining engineer, 134 College Ave., Houghton, Mich.

Splicing Wire Rope

Wire rope is susceptible of almost perfect splicing and the operation is so simple, states F. L. Johnson in *Power*, that it may be learned in an hour by any mechanic who is at all skillfull in the use of ordinary tools. For all kinds of transmission rope the long splice is used and should not be less than 16 ft. in length for ½-in. rope and increasing to 30 ft. for the larger sizes.

Where the splicing must be done in position, rope blocks are used to draw the wire taut, as in Fig. 1, care being taken to make fast far enough from the ends to leave plenty of room for the splice and the men who make it. If possible, it is better to hold the rope taut, mark the splice on both ends, by securely winding with No. 20 annealed-iron wire, throw it off the sheaves and make the splice on the floor or staging, as may be most convenient.

The strands of both ends are unlaid, back to the points wound with wire, the hemp core cut off and the ends of the rope brought together with the strands interlaced, as shown in Fig. 2. Any strand, as *a*, Fig. 3, is now unlaid and closely

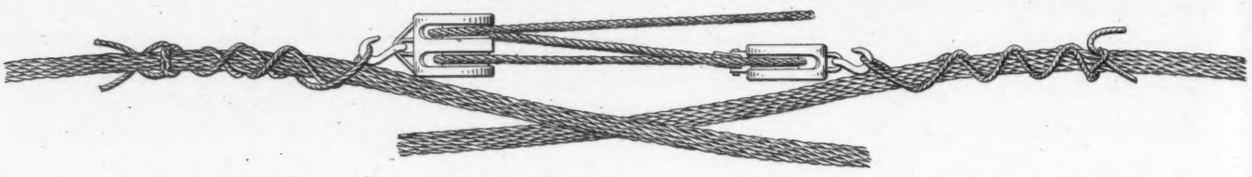


Fig. 1.

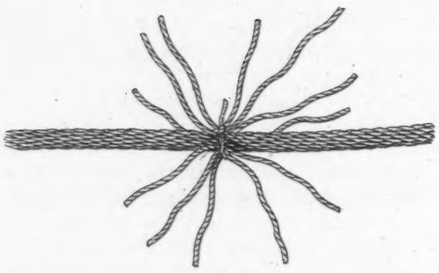


Fig. 2.

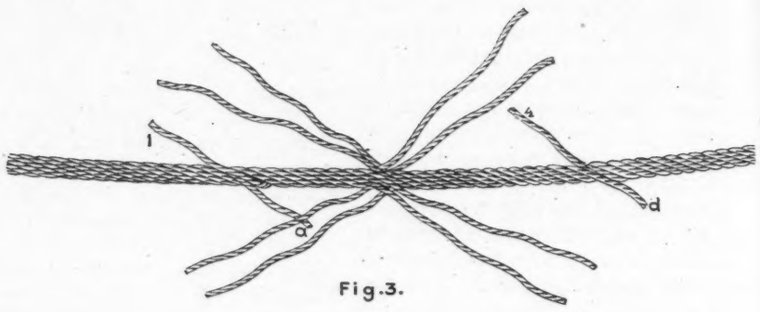


Fig. 3.

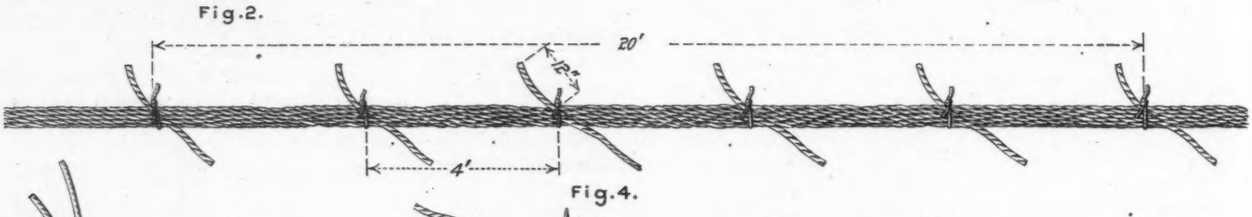


Fig. 4.

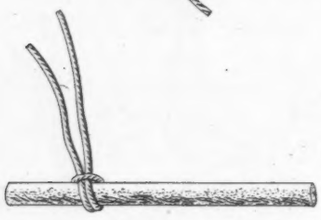


Fig. 5

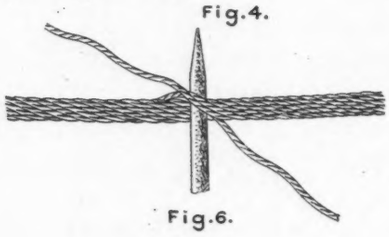


Fig. 6.

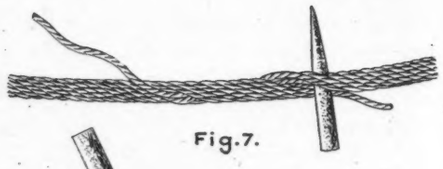


Fig. 7.

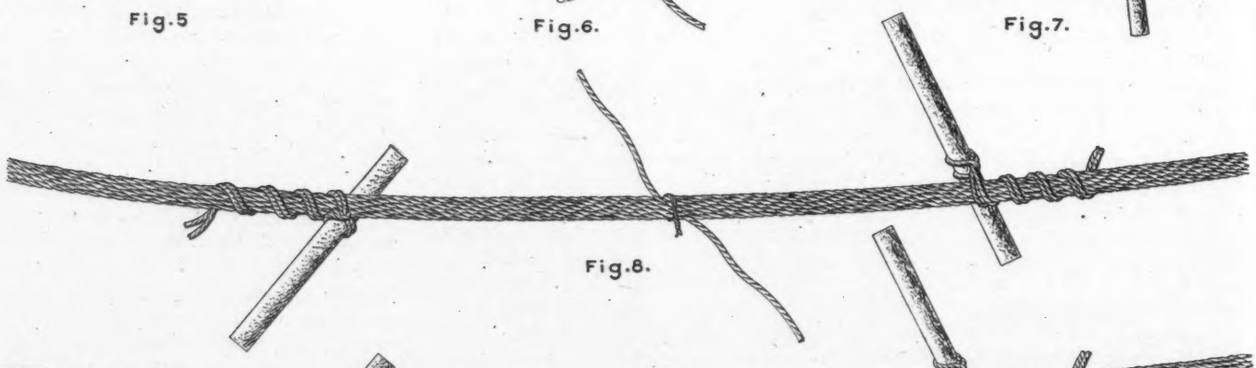


Fig. 8.

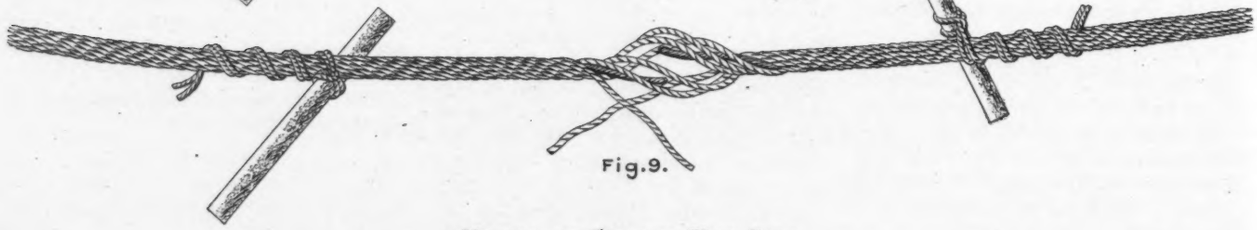


Fig. 9.

METHODS OF SPLICING WIRE ROPE

followed by the corresponding strand 1 of the other end of the rope which is pressed closely into the groove left by the unlaid strand. The unwinding of one strand and the inwinding of the other are continued until all but about 12 in. of strand 1 is laid in, when *a* is cut off at the same length and both strands securely tied with cord. Strands 4 and *d* are next treated in the same way and the process is repeated with each pair of strands until all are laid and cut, the projecting ends being tied as shown in Fig. 4 to prevent unwinding.

When this has been done the splice is bent and worked in all directions until the tension in all the strands is equal and the rope as flexible there as elsewhere. If this is not done and there is more tension in some of the strands than in others when a stress is put on the rope, these strands will pull into the rope, making a bad looking and weak splice.

Next, the open or free ends of the 12 strands are carefully trimmed and wound with fine wire. Two rope-and-stick clamps, Fig. 5, are now secured to the rope, one on each side of an end crossing, as in Fig. 8, for the purpose of untwisting the rope to allow tucking the strand ends into the middle of the rope.

There are two ways of tucking in these ends. They are first straightened with a mallet; the long ends of the rope-clamp handles are twisted in opposite directions, separating the strands and exposing the hemp core, which is cut off and pulled out between the points to where the tucked-in strands will reach and the ends forced into the place formerly occupied by the core.

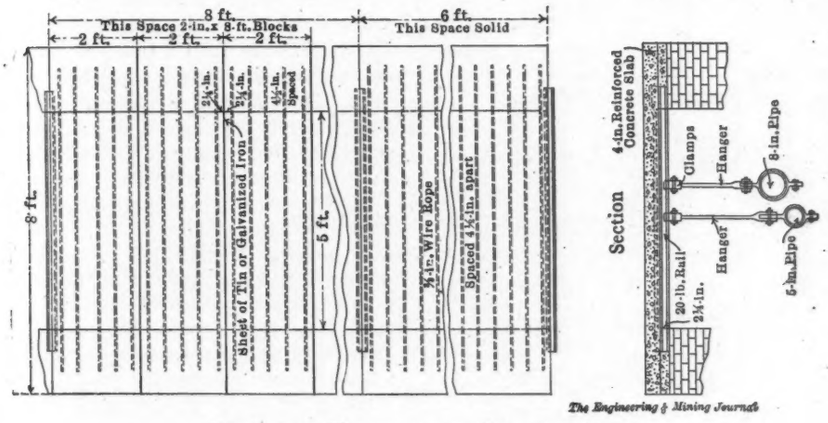
This is most easily done with the aid of a marlin spike, which is passed over the strand that is to be tucked and under two strands of the rope, Fig. 6, and moved along the rope spirally following the lay and forcing the free end, as shown in Fig. 7, into the core space.

In the other method the strands are more widely separated by untwisting the rope with the clamps, Fig. 9, slipping the free end in between the strands and correcting slight kinks by the use of a mallet. The order in which the ends are tucked in is immaterial. Some operators prefer to tuck all the ends pointing in one direction before any of those pointing the opposite way, while others finish each pair of ends in series.

If the foregoing directions are intelligently followed the splice will be uniform with the rest of the rope, of nearly equal strength throughout, and after a few hour's use it will be almost impossible to detect the splice. Four-strand hemp ropes can be spliced in the same way this splice being known among riggers as the long splice.

A Tunnel for Steam Pipes

In many of the mines of the Lake Superior copper country it is the custom to carry the steam pipes in tunnels from the boilers to the hoists and other machinery. The air pipes are carried along with the steam pipes, where they have the same direction of travel.



STEAM-PIPE TUNNEL WITH CONCRETE ROOF

At the Baltic mine such a tunnel is covered with reinforced-concrete slabs. There are two sizes of tunnel used. One with a span between walls of five feet and the other with a span of three feet. The side walls are of stone and the pipes are suspended from 20-lb. rails put in along the wall at intervals of about 20 ft. or just so as to catch the pipes near the flanges. These rails are cut one foot longer than the span so as to have a hold of six inches on each wall.

The manner of swinging the pipes from the rail by a combination of clamps, hanger rods and collars is shown in the accompanying drawing. This rail is carried about three inches below the concrete roof so that the rails can be made to help carry the form timbers for the roof by putting in wedges to be knocked out later. Of course, intermediate supports are also required. The concrete slabs are reinforced by means of single strands of ⅜-in. wire rope obtained by unlaying 1¼-in. hoisting rope that had been discarded as no longer good enough for use in the shafts. The slabs are made to have a hold of 18 in. on each side, being eight feet long for the five-foot span and six feet long for the three-foot span. These reinforcing ropes are cut one foot shorter than the length of the block, or slab. In the slabs for the five-foot tunnel they are put in at 4½-in. centers while in the three-foot tunnel they are put in at six-inch centers.

The slabs are formed in place. For a stretch of from 40 to 60 ft. the slabs are formed to stay in place. Then four slabs that are detachable are made by placing a piece of paper or some other such material along the walls to break the bond between the concrete and the masonry, while between slabs a piece of wood or tin that will break the continuity of the slabs in that direction is put in. Wood strips are the best as they shrink and can be taken out most easily after the concrete has set. These removable slabs are made two feet wide. By taking off the four, a length of pipe about 20 ft. long can be put in place as the tunnel is about five feet deep. It is not convenient to work a pipe along the bottom of the tunnel for more than about 30 ft. or so. The concrete slabs are four inches thick and are made of a 1:3:5 mixture.

A Cheap Mine Road

BY S. H. BROCKUNIER*

Recently I had occasion to build 2600 ft. of a side-hill road to the Erie mine, for the double purpose of cutting off a mile of distance and a stretch of deep snow. I had only a week to complete the road and the problem was further complicated by fallen trees three or four feet in diameter, and several hundred feet of swampy ground, so I decided to place main reliance on dynamite.

The first day only two pairs of men were put to work, one pair at each end of the road, in order to see how much they would accomplish and how many men would be needed. In this way I estimated that eight men would complete the road in seven days; as a matter of fact the ditching of the swamp detained them a day longer and eight days were actually consumed in the construction.

The men were given 40% dynamite, fuse, caps, augers, and bars. They were told to put five-foot vertical holes along the upper side of the proposed road and loosen the earth with dynamite, regulating their charges so as to move the earth as much as possible towards the downhill or lower side. In this way not a pick was used on the entire road and shovel-

*General manager, Erie Consolidated Mines Co., Nevada City, Calif.

ing was reduced to a minimum. When a fallen tree was encountered it was bored for a charge of dynamite, blasted in two, and pushed out of the way.

The swamp was corduroyed with eight-foot slabs blasted from fallen trees. These slabs or poles should have been 12 ft. long because if shorter they rock too much in soft mud. Cutting and splitting trees with dynamite is an easy method when compared with axe, saw hammer and wedges and the necessary men to handle such tools. The total cost of this road was, seven boxes of dynamite $49; fuse and caps, $13; labor $202; total $264. This is at the rate of 10c. per lineal foot for an eight-foot road. The day the road was completed a 6000-lb. load was drawn over it with ease and it has been teamed over steadily ever since.

Placing Air Pipes in Shafts

Extensions of the compressed-air mains in the Champion shafts of the Copper Range Consolidated Co., in the Lake Superior copper country are made in 200-ft. lifts. The work is commenced by placing a tee in the shaft opposite the station at the bottom of the lift; then carrying up the piping for 200 ft. to connect with the air main already in position.

The tee at the lower station is securely fastened by an iron yoke to a carrier timber. The pipes are then lowered and put together until the next level above the station is reached. There another tee is put in the line immediately above and below which yokes are used both to anchor the main and to prevent swinging at that point. When this tee has been put in place the other pipes are lowered and, by using a pipe of the necessary length, the top of the extension is brought to within six or eight inches of the bottom of the main already in place. A flange is screwed tightly home on the upper end of the top pipe and yokes are attached to anchor the line in position.

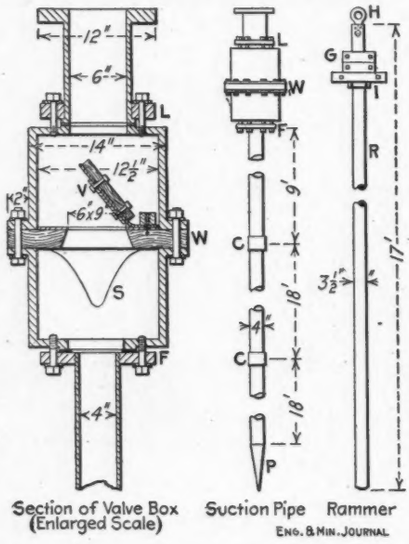
The connection with the part of the main already in place is made after 1 p. m. on Saturdays at which time no drills are running in the mine so that the air can be shut off without interfering with mining work. Jacks are placed under the lower end of the extension pipe and the yokes are loosened so that all the weight comes on the jacks.

The blind flange on the lower end of the part of the shaft main already in place is removed. The flange on the upper end of the extension is turned in the direction of unscrewing so that the bolt holes in upper and lower flanges are in line. The little loosening usually necessary does not cause leakage. Then the 200-ft. length of pipe is raised by the jacks until the flanges come tight together. The flanges are then bolted together, usually with a gasket between to make a tight joint. The yokes, of which there are two for each 100-ft. length of pipe, are then tightened to hold the main in position.

During the operation, large wrenches are used to prevent turning of the upper part of the line when the extension is being raised. Making the connection takes an hour; two men are needed at the jacks, four at the yokes and two, with the boss timberman at the point where the connection is made.

Lowering the Water in a Choked Shaft

In the JOURNAL of March 9, 1912, an article was published under the above caption being a portion of a paper contributed to the Institution of Mining and Metallurgy by Cyril Brackenbury. In this article a special valve box and suction pipe were described. The pipe was provided with a pointed end so that it could be driven through the debris that choked the Harvey shaft, and be used as the suction pipe for the centrifugal sinking pumps that constituted part of the unwatering equipment. At the request of several members of the institution, Mr. Brackenbury has provided[1] a sketch of the valve box, suction pipe and rammer which is reproduced in the accompanying illustration.



VALVE BOX AND APPLIANCES

In Figs. 1 and 2 the screw flange *F* on the top of the pointed suction pipe, is shown bolted direct to the bottom of the cast-iron valve box, with two rubber washers making a watertight connection. In Fig. 1 the position of the strainer bent in a synclinal fold is shown by the line *S*. The strainer is attached at the ends to the 2-in. wooden plate *W*, which is bolted between the halves of the iron valve box. A hole 6x9 in. is cut through the wooden plate to allow the water to pass up through the valve box into the pump. A thin iron plate is fastened on the upper side of the wood, and an ordinary light clack-valve is attached, to fit the 6x9-in hole. At the top of the box a short length of 6-in. pipe is fastened in the same manner as the suction pipe below, except that the flange *L* is loose instead of being screwed. The top of this short pipe can be connected to the U-piece at the bottom of the pump by means of flexible piping, or by an ordinary reverse bend. It is possible to do without the short length of pipe, and make direct connections between the top of the valve box and the bottom of the flexible pipe or reverse bend.

Fig. 2 is given in order to show the method of using the pointed suction pipe and valve box. The 4-in. pipes used are sometimes as long as 18 ft., but they have been drawn short for convenience.

The rammer *R*, which must weigh about 500 lb., is made from a piece of old iron shafting 3½ in. diameter and about 17 ft. long. A handle *H* is screwed into the top to which the rope is connected. A small iron ring *I*, and two or three glands *G*, are fastened firmly on the rod near the top. The ring *I* forms the hammer surface which strikes the top of the flange when driving the pipe. A screw flange similar to *F* is screwed to the first length of pipe, which carries the conical steel point *P* at the bottom. The rammer is inserted in this pipe and is operated by several men alternately pulling and slacking off on a rope passing over a single block. After the first pipe has been driven down for almost its entire length, the screw flange is taken off and a sleeve coupling put in its place, to which another length of pipe is screwed. The process is repeated until the point at the end of the 4-in. pipe has been driven down below the bottom of the choke. The point is then blasted off and the upper length of pipe fastened to the valve box.

[1]Bull. 90, I. M. M.

Gasoline Locomotive for Calumet & Hecla

The Calumet & Hecla Mining Co., has purchased a 7-ton gasoline locomotive for use at the smeltery where there are many track curves of short radius. The gasoline locomotive will be used for hauling supplies. It is to be given a thorough test and if found satisfactory it is probable that a few more will be purchased eventually to replace the small steam locomotives now used for hauling concentrate from the stamp mills to the smeltery.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Take Up Device for Elevator Belts

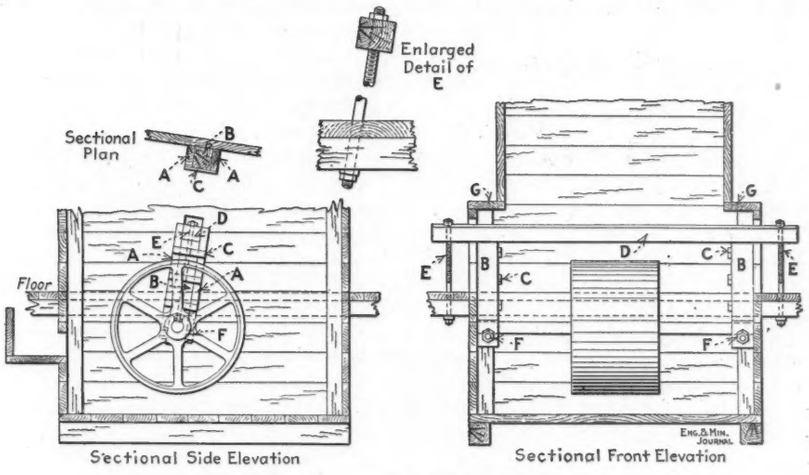
Belt elevators for raising wet pulp and tailing are used in all the mills of the Joplin district. In some mills the device for taking up the slack of the elevator belts described in the JOURNAL of Jan. 21, 1911, is used, in others the screw take-up device shown herewith.

To each side and within the lower part of the elevator housing two 2x6-in. guides *A, A* are nailed at a distance of 4 in. apart. These guides are parallel to the line connecting the centers of the upper and lower pulleys. Between each pair of guides a piece of 4x6-in. timber *B*, of suitable length is slidingly mounted and is held from falling out of the guides by the cleats *C*. The lower end of each of these timbers is forked to carry the shaft of the lower pulley.

Slots are cut in the side of the housing and above the floor line so that a transverse 4x6-in. timber *D*, which is longer than the elevator housing is wide, can be extended through the elevator housing through the slots mentioned and rest between the guides and upon the upper end of each of the timbers *B*. The slots are of such a length as to permit an up and down movement of the transverse timber between the guides of about 18 inches.

Near each end of the transverse timber *D* and outside of the elevator housing, a hole is bored through which the upper end of one of the take-up bolts *E* passes. The lower end of each of these bolts is held by a nut in the floor beams of the mill. The upper ends are threaded for a length of 18 in. or more. It will be seen that upon tightening the nuts on the upper end of each of the bolts *E*, the transverse timber *D* will be drawn down in the slots and press the timbers *B* downward in the guides, thus lowering the pulley and tightening the elevator belt. The forked ends of the timbers *B* are usually provided with a bolt *F* which prevents the pulley dropping in case the belt breaks.

The elevator housing is generally made 20 in. wider in the lower than in the main part as shown at *G*, so that the overhang protects the sliding timbers and their guides from the spillage from the buckets. The device has the advantage over the lever tightener in that the adjustment part of the take-up mechanism is outside the housing.



SCREW TAKE-UP DEVICE FOR LOWER ELEVATOR-PULLEY

A Flexible Decanting Hose

BY W. P. LASS*

The concentrate from the Frue vanners in the Alaska-Treadwell and affiliated mills is cyanided after regrinding in tube mills at the new cyanide plant. Agitation in cyanide solution is effected in Pachuca tanks in which the concentrate is allowed to settle at the end of the operation and the clear supernatant solution is decanted.

Decantation takes place[1] through a flexible hose which is made by wrapping canvas coated with tar around pieces of old boiler-tubing, 3 in. in diameter and 4 in. long, spaced ¾ in. apart. The canvas between the short lengths of tubing is wrapped with wire, making the diameter of these spaces slightly smaller than that of the tubing, thus insuring flexibility as well as avoiding the shifting of the tubing.

Attached horizontally to the top of the flexible hose is a 3-in. slotted pipe. In operation this slotted intake floats by the aid of two adjustable air-cylinders. The arrangement of these cylinders permits the submergence of the intake pipe to any depth desired.

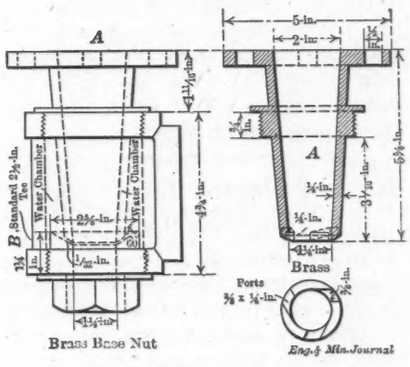
*Cyanide superintendent, Alaska-Treadwell Gold Mining Co., Treadwell City, Alaska.

[1]Bull. A. I. M. E., February, 1912.

A Simple Vortex Classifier

The details of a simple type of vortex classifier that is used in some of the mills of southwestern Missouri, are shown in the accompanying drawing.

The classifier can be used either in the pockets of a launder-type classifier or in a deep-pocket classifier as is shown in the drawing. In the pocket form the pulp is allowed to build up to give the proper slope to the bottom, whether there be one or more hydraulic attachments in the pocket. In both types a baffle board is used above the pocket proper.

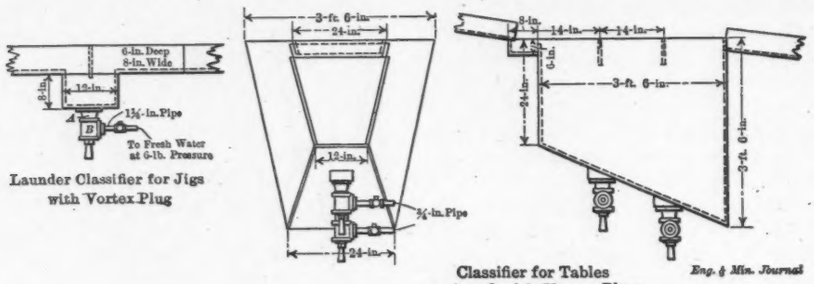


VORTEX PLUG IN JOPLIN CLASSIFIERS

The details of the hydraulic attachment are shown enlarged. The attachment consists of a brass casting *A*, which fits into *B*, a standard 2½-in. tee which is fitted with a bushing so as to take the sorting water from a ¾-in. pipe. The water from the water chamber formed by the tee passes through vortex openings in the bottom of the casting *A*, the brass fitting *C* being screwed into the bottom of the tee until there is only about 1/32 in. opening between the casting *A* and the nut *C*. The pulp that settles past the vortex current is drawn off through the fitting *C*, the flow being regulated by means of wooden plugs of which

several are provided with different size holes bored through them. This whole attachment bolts to the bottom of the classifier proper.

The construction of this hydraulic attachment is simple indeed. A cheap tee is used as the outside container with two cheap brass castings that are as easily replaced, owing to the simplicity of the design, as the inside parts. Moreover, the classifier is capable of a certain amount of adjustment in regard to the vortex by changing the distance between the interior parts. A peculiarity of the vortex is that it is directed downward. In this way clogging from shut-downs is less liable to happen, while the ease with which the whole device can be taken apart permits its being cleared readily in case clogging should result from the use of dirty sorting water.



VORTEX PLUGS ATTACHED TO LAUNDER AND TABLE CLASSIFIERS

An Old Device for Plugging Furnace Taps

While superintending the operation of a small blast furnace smelting copper ore, at a mine in one of the Southeastern states, an engineer found, in a scrap pile a device that was designed to take the place of the cone of brasque usually employed for plugging the discharge tap for a blast furnace.

This device had consisted of a hollow egg-shaped knob of copper, the long axis of which measured four or five inches. The larger end was bored and threaded to take one end of a 1-in. pipe about 6 ft. long; the other end of the pipe was fitted to a tee. Within the 1-in. pipe a smaller, but longer pipe extended through a bushing in the tee up into the hollow knob. In operation water was introduced by attaching a small hose to the part of the smaller pipe extending through the tee and several inches below the bushing. The water escaping from the end of the smaller pipe into the hollow knob filled that space and returned by the annular passage between the two pipes to the tee, to the side outlet of which a discharge hose was attached.

When slag and matte ceased to run from the furnace after tapping, it was the intention to push the knob of the device into the tap-hole and hold it there until the slag rose above the tap, then the cold knob was expected to form a chill of slag and plug the hole. This it did, but the furnaceman had to hold the device until the slag level rose above the tap and while thus waiting slag would run past the point and chill, making it difficult to remove the device when the chilled slag had plugged the tap. So effectually was the tap plugged when the chill did form that sledging the bar was always necessary to open it again. To add further to the furnaceman's troubles he was constantly tripping over the two lengths of hose, and when these were hung from the roof of the shed they were in the way. The device is described as it is possible that others have thought of a similar scheme, but have not anticipated the objections.

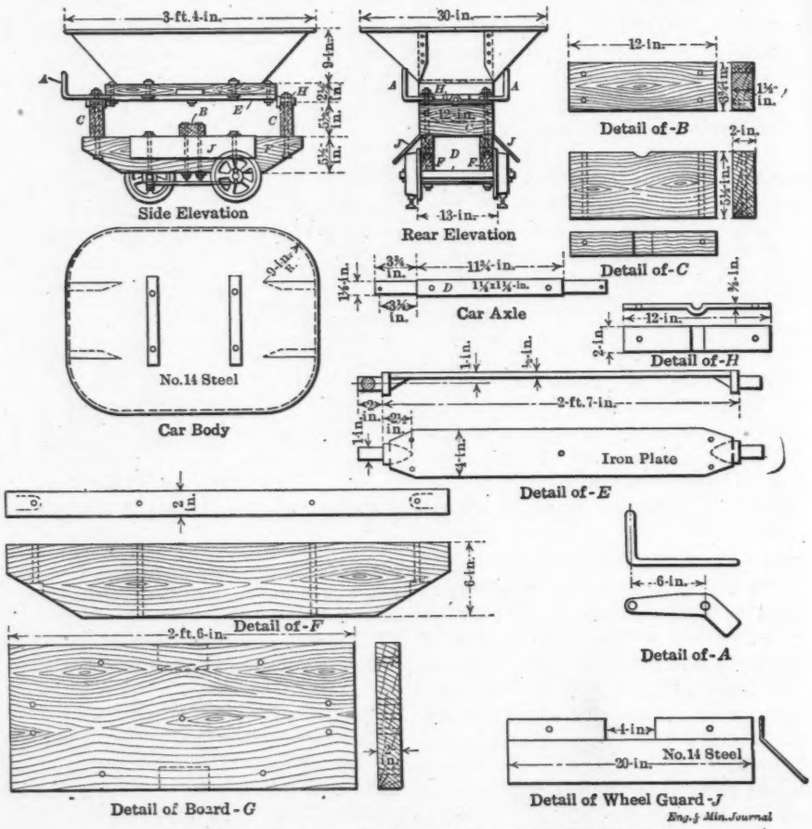
Tram Car for Concentrate

The details of the side-dumping car used in the Joplin lead and zinc district for tramming concentrate from the jigs and tables to the bins just outside the mill building, are shown in the accompanying drawing. The body is made of No. 14 iron riveted together at the four rounded corners.

The car truck, as the detail drawing shows, is made of 2-in. oak main pieces, *E*, tied together by the bearing pieces *C*, and the cross brace, *B*, at the center, which last limits the dump of the body so that it cannot come down far enough to mash the guard plates *J*, that are bolted to the truck to keep the concentrate from running down on the wheels and axles while the car is being dumped.

The dumping of the car and its load is prevented by the arms, *A*, which are bolted to the rear bearing piece *C*. The car is low. Its top comes only about 2½ ft. above the floor. It seems to be well adapted to the carrying of concentrate when it is necessary to shovel the concentrate from the boxes of tables and side-dump them into the receiving bins.

Owing to the fact that the box of the car is riveted at the corners water drains out of the concentrate as it is trammed to the bins. On that account the coarse concentrate is loaded in first to make a bed for the fine concentrate.



TRAM CAR FOR CONCENTRATE USED IN JOPLIN MILLS

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Labor Output of the U. S. Steel Corporation

The United States Steel Corporation, according to its annual report, operates 149 manufacturing plants, consisting of 125 blast furnaces; 35 bessemer converters; 270 openhearth furnaces; 653 rolling mills; 58 wire mills; 55 pipe and tube works; 16 tin-plate mills; 19 bridge and structural plants; 36 galvanizing and tinning departments; four splice-bar and rail-joint shops; five spike, bolt and nut factories; five departments for cold-rolled products; 24 iron, steel and brass foundries; 11 sulphate of iron plants; five cement plants; 70 warehouses; and 24 miscellaneous works. Besides these plants it owns, or operates, 79 iron mines in the Lake Superior district; 10 are situated on the Menominee Range; 10 on the Marquette; nine on the Gogebic; one on the Baraboo; five on the Vermilion; and 44 on the Mesabi Range. In addition to these it owns or controls a large acreage of undeveloped lands. In Alabama it owns 21 iron mines and in Georgia, two.

In the Northern districts it owns 136,348 acres of coking-coal lands, 94,153 acres of steam coal and 24,374 acres of surface. On these lands it operates: 78 coke plants, at which are 23,947 bee-hive ovens and 1172 byproduct ovens. In addition to these, there are 31 coal plants not connected with the coke plants. The Southern coal and coke properties consist of over 300,000 acres, on which are six coal plants, operating 23 mines; 10 coal-washing plants, and seven coke plants, the latter comprising 2947 beehive ovens. During 1910, the average number of employees for all the properties was 218,435, and in 1911, 196,888 men, including those employed by the transportation department.

TONS PER MAN

Iron ore mines: The average tons of iron ore mined per year, per man employed in the iron-ore mines during 1910, was 1490 tons, and for 1911, 1380 tons. The average for the two years is 1435 tons per man.

Coal and coke: The figures in the report include tons of coal mined and coke manufactured, 73.6% of the tonnage thus reported is manufactured coke for the year 1910; and for 1911, 56.8%; or an average of 69.9% for the two years. Based upon the tons of coke and coal not included in the coke production, the average tons per man for the year 1910 was 786, and for 1911, 849 tons. An average of 817 tons for the two years.

Manufactured and miscellaneous products: The figures reported include cement and miscellaneous products. The actual number of men employed in each separate department cannot be extracted from the report, however, the tonnage thus included will not materially affect the average for the steel products. The annual tons per man employed in 1910 in these departments was 212 tons, and in 1911, 205 tons. An average of 208 tons for the two years.

General average: Of the total products, including tons of ore produced from the mines, coke manufactured, coal mined not included in the coke production, and other manufactured products, the average tons per year per man was 390 in 1910, and 378 in 1911. The average for the two years is 385 tons. Of manufactured products, not including coke, the average tons per year per man employed in mining, coal and coke industries, furnaces, mills, etc., was 168 tons in 1910, and 163 tons for 1911. An average of 166 tons for the two years. These averages do not include men employed, or tonnage handled by the transportation department, except for the total average men employed for 1910 and 1911, as stated.

Labor Output of the Republic Iron & Steel Co.

The Republic Iron & Steel Co. operates 29 mining properties, of which 20 are iron mines, seven coal and coke properties and two limestone quarries. The properties are divided into two divisions: The Northern, which consists of 15 iron mines, three in Michigan and 12 in Minnesota; and three coal and coke properties in Pennsylvania. The Southern division consists of five iron mines, four coal and coke properties, and two limestone quarries, all in the Birmingham district, Alabama. Of the 10 blast furnaces owned, five are in Ohio, two in Pennsylvania and three in Alabama. Ten active plants were in operation in 1911, six of which are in Youngstown, Ohio, two in Indiana and two in Illinois. Two bar-iron mills in the Birmingham district and one in Toledo, Ohio, were inactive during the year.

The finished products of the company are merchant-iron bars, bessemer and openhearth-steel bars, light structural and agricultural shapes, standard and hand spikes, bolts, nuts, turnbuckles, cold-drawn bars, tubular products, bessemer and openhearth billets and sheet bars, and foundry, bessemer and basic pig iron.

TONS PER MAN

Iron Ore Mines—During the last five years the average annual tons of iron ore produced per man employed at the mines is as follows: 1907, 611 tons; 1908, 850 tons; 1909, 999 tons; 1910, 999 tons, and in 1911, 1049 tons. Years 1907 and 1908 were during a period of low production.

Coal Mines and Coke Ovens—The annual reports of the company do not give the tons of coal mined; the tonnage reported is manufactured coke. Based upon this tonnage as reported, the average annual tons of coke produced per man employed in the coal mines and at the coke ovens has ranged as follows: 1907, 306 tons; 1908, 311 tons; 1909, 383 tons; 1910, 388 tons, and in 1911, 397 tons.

Finished and Semi-finished Products—Figured on the average men reported as employed at the works and the annual tons reported, the average annual tons of manufactured product per man employed in the works is as follows: 1907, 92.4 tons; 1908, 89.6 tons; 1909, 135 tons; 1910, 123 tons, and in 1911, 107 tons.

Furnaces — Based upon the average men reported as employed at the furnaces and the annual tons of pig iron produced, the average annual tons per man ranged as follows: 1907, 348 tons; 1908, 489 tons; 1909, 616 tons; 1910, 550 tons, and in 1911, 546 tons of pig iron. The limestone consumption, based upon the total tonnage mined in the last five years and tons of pig iron produced, is apparently about one ton for every six tons of pig iron produced.

Compressed Air per Ton Mined

Compressed air is used according to the report of the Copper Queen, at the rate of 0.0102 cu.ft. per min. per annual ton of ore produced. If this is the maximum amount required it checks well with the rated capacity of the compressors required at the Goldfield Consolidated, Goldfield, Nev., where two compressors are used with a rated capacity of 1500 cu.ft. each per min. Based on an output of 330,000 tons annually, this is approximately 0.0091 cu.ft. of air per minute for an annual ton.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Austrian Radium Monopoly

According to a recent statement in the Austrian press, the government has bought the only two privately owned radium mines at St. Joachimsthal. The purchase price is said to be $609,000 for the two mines "Sachische Edelleutestollen" and "Hergottszeche," writes Consul W. L. Lowrie in the *Daily Consular and Trade Reports.*

During the last four years many efforts have been made by various financial institutions of Germany and France to purchase these deposits of pitchblende. It is estimated that the two mines will annually yield about 3 grams of radium and 3000 kg. of uranium salts, the latter valued at $30,000. It is claimed that the annual production will be 5 grams (valued at $400,000) as soon as the factory at Joachimsthal is in full operation, using the ore from the mines recently acquired in addition to that taken from the old silver mine which has hitherto been the source of supply.

Centrifugal Slimes Filter

Before the Society of Arts recently, a paper was read by W. J. Gee on "The Separation and Grading of Solids Suspended in Liquids." This new process (*Engineer,* Feb. 12, 1912) consists in passing the liquid through a rapidly rotating drum, whereby the solids are caused by centrifugal force to be deposited on the removable lining of the drum, while the liquid passes away clear of all suspended matter. The current passes from end to end, with the result that the solids are deposited in graded order, the coarser near the inlet end and the finest near the outlet end, all the intermediate grades being deposited between the extremes.

Australian Tin Scrap Plant

Arrangements are nearing completion, says *Daily Consular and Trade Reports,* for the establishment of a factory at Sydney for the extraction of steel and tin from tin clippings, the residue of the canning industry. Large quantities of tin clippings are available annually for export purposes in Australia. It is known that 3500 tons are exported yearly to Germany. Recently a company was formed with a capital of £15,000, for the establishment of a factory at Sydney. The managing director of the Flushing (Netherlands) Electro Tin Works has gone to Australia to forward the enterprise, and those interested are confident of rapidly establishing the necessary works in a Sydney suburb. A number of contracts have been arranged with firms in a position to supply clippings.

Oil in Wyoming

The Lander and Salt Creek oil fields of Wyoming are the subject of a bulletin, recently reissued by the U. S. Geological Survey. Oil was discovered in this field by Bonneville in 1833, but until 1867 it it was practically unknown except to hunters and trappers. The first drilling was done in 1883, and although the wells were productive they were, on account of keen competition, soon abandoned. The wells remained packed until recently, when operations were resumed on a more extensive scale.

Perhaps the most interesting well in the Salt Creek oil field is one drilled in 1910, which struck oil under pressure in shale at a depth of 1176 ft. This well yielded an unusually large amount of oil for a shale well. The oil is said to make an excellent fuel, and as it contains a heavy asphalt base, is good for oiling roads.

Titatium or Zirconium Glass

The glass formed by fusion of silica with oxides of the carbon group, preferably titanic or zirconium oxide (Fr. pat. 432,786) has been found very resistant from the chemical and thermal points of view, and is more easily worked than pure quartz glass. The product is known as siloxide. The strongest of the zirconium glasses (Z-siloxide), contained 1% of ZrO, while the best thermally contained 0.5 per cent.

The titantium glasses (T-siloxide, 0.1 to 2% of Ti) have a somewhat lower resistance to compression than quartz glass (*Journ. Soc. Chem. Ind.,* Mar., 1912), but resist transverse fracture better than the latter, and are superior even to zirconium with respect to thermal properties.

Early Uses of Platinum

A few days ago W. Burton read a note before the Manchester Literary and Philosophical Society, says the *Engineer,* Feb. 16, 1912, on "The Earliest Industrial Uses of Platinum," in which he stated that the metal had been employed by Wedgwood in the latter half of the eighteenth century for coating pottery. Attempts had previously been made with gold for the same purpose, and platinum, then little known, offered equally attractive results, specimens of modern work being shown. Platinum ores were at one time ordered to be thrown into the sea by the Spanish government, owing to the metal being used for debasing the coinage.

Diffusion of Metals

A remarkable example of diffusion of solid metals has been observed by Messrs. G. Bruni and D. Meneghini, and is quoted in the *Electrical World.* A nickel wire was coated with copper by electrolysis to a thickness such that the two metals were in the same proportions as in the alloy constantan—40% Ni., 60% Cu. The compound wire thus formed was then maintained at a temperature of about 1000° C. for 157 hr. Its resistance was 0.0260 ohm at the start, and was measured at intervals. It gradually rose to 0.2105 ohm, at which it became practically constant. This indicated that the wire had become converted to constantan, and the fact was proved by chemical analysis.

African Freight Cableway

A Bleichert cableway in German East Africa is described in *Engineering News,* Feb. 29, 1912. It covers a distance of 5⅛ miles in an air line, and ascends 4995 ft. in that distance. To avoid excessive spans (6000 ft.) there are two angle stations, through which the haulage cables run, but where the main cables come to an end, and are put under tension. The cars go through on tracks, the change being made by manual labor. Some of the sections have a gradient as high as 41°. The cars are built to take logs up to 46 ft. long, and consist of two carriages with no other connection than the cable and the load. Owing to danger from termites, all stations and supports are steel construction.

Nodulizing by the Grondal Process

According to an estimate in *Echo des Mines,* Feb. 15, 1912, about 200,000 metric tons of nodules are made yearly in England from "blue billy," while the production of the world is given at over 1,000,000 metric tons of nodules, corresponding to 650,000 metric tons of iron.

Cyanide Mill Metallurgical Records

By E. H. Webster *

Metallurgical balance sheets are of value in exposing differences between theoretical extraction and actual bullion recovery. A complete set of forms for recording the essential data is given, together with suggestions as to methods of obtaining this information.

*Los Angeles, Calif.

Readers of technical journals on this side of the Atlantic, during the last year or two, have been treated to numerous articles describing modern South African milling practice, with accounts of the magnitude of the plants, the efficiency of the crushing machinery, the perfection of the treatment schemes, the low costs attained, etc. This matter has been of great interest to metallurgists and mining men in general; much information of value has been elicited by the work of the Rand metallurgists and mechanical engineers, and the reports and discussions of the various technical societies of the Rand have almost brought some readers to believe that operations there are but little short of perfection, and that in comparison therewith our American and Mexican practice is crude and amateurish in conception and execution.

East Rand Proprietary Shortage

In view of these glowing accounts of modern Rand attainments, it was somewhat disconcerting to learn from the Johannesburg correspondence[1] that at one of the foremost of these new concerns, the East Rand Proprietary Mines, "£50,000 worth of gold had been let go to waste out of two or three separate cyanide plants without anyone knowing anything about it." Not that the difficulty of getting bullion recovery to correspond with theoretical extraction is new, on the Rand or elsewhere—witness the former Rand and Westralian institution of the "secret reserve"—but it is surprising to realize that the discrepancy between theory and fact in the work of a supposedly well managed company of this character, could have grown to such magnitude without having been the subject of earnest attention and prompt remedial action, at some earlier stage.

Subsequent developments seem to show that this loss was not entirely a metallurgical one, the above statement being made in an attempt to cover the accumulated shortages due to inaccuracies in the estimates of tonnage and grade of ore treated, and to ascertain irregularities on the part of the management as to the time of making cleanups so that an increased yield could be reported for a given period.

While this occurrence, taken in connection with the Victoria Falls electrical power troubles, the failure of the City Deep mill, and the shortcomings of the Randfontein Central (all of which your correspondent mentions), tends to shake our confidence in the efficiency of latter-day Rand engineering and to cast the shadow of doubt over much of the information emanating from that field, it emphasizes the necessity which exists at many mines of lesser magnitude, of a metallurgical balance sheet. By this I mean, a metallurgical account, showing monthly and cumulatively the total metals delivered to the mill, the distribution of these to the various departments of the plant, the actual recovery in bullion and other marketable forms, the metals held in the form of slags and other secondary products, the loss in tailings, and the metals which should still exist in the mill at each periodical cut-off, whether in coarse ore bins, pulp and fine ore in sundry stages of treatment, zinc boxes or presses, or mill circulation. For the purposes in view, all this information should appear in terms of units of weight, values being neglected.

[1]Eng. and Min. Journ., Dec. 16, 1911.

Accuracy of Tonnage Estimates Important

As the value of any system of metallurgical accounting rests directly on the accuracy of ore weights and metal assays, the determination of these basic facts should be the subject of most careful consideration and investigation on the part of the mine manager. The basis or starting point of the metallurgical account is the dry tonnage charged to the mill, and it is of the utmost importance that this tonnage be ascertained within the smallest practical limit of error. Whether the charge be made on the basis of tonnage actually passed through the crushing machinery, or on that of tonnage delivered to the mill bins, is largely a matter of conditions and individual preference.

Certain difficulties and indeterminate errors usually attend calculation on the basis of tonnage delivered to mill bins, except in mills of very modern design, where the ore is sampled automatically and weighed before reaching the mill bins; or in small mills, and mills close to the mine mouth, where it is practicable to empty the mill bins before cut-off. In the former case, the tonnage in bins at the time of cut-off is covered by the balance entry for metals existing in mill, the mill being charged with the dry tonnage and assays delivered to its bins. In the latter case, the ore should be weighed in the cars or tramway buckets before it enters the mill bins. As sampling of an intermittent stream from a rock breaker is unreliable in the extreme, the samples for value and moisture should be taken at regular intervals between the ore feeders and the crushing machines.

If the mill bins are allowed to run empty at cut-off, the tonnage crushed is the tonnage delivered. This method will give results as close to the truth as is practicable, little or no change in the moisture being suffered while the ore is in transit through the mill bins. If the bins are not allowed to run empty, errors will be introduced into the calculation, varying with the grade of the ore and the ability of the superintendent or foreman to guess the quantity lying in the bin and for which allowance must be made.

Automatic Weighing at Hedley

In cases where the ore has not been passed through a sampling mill, the best method of ascertaining tonnage and value of mill feed, in my opinion, is that employed by Frank A. Ross at the mill of the Daly Reduction Co., Hedley, B. C., and described by him in the Engineering and Mining Journal of Oct. 24, 1908. I give a brief outline of this scheme, with certain additions which should improve its operation. A scale car of standard pattern, with registering beam, runs on a track above the feeder hoppers. This car is filled from the mill-bin gates and trammed to the hoppers as required. Before dumping, the beam is brought to balance, a ticket inserted in the sliding counterpoise, a lever pressed, and the ticket dropped into a slotted box near the hopper. Once a day or once a shift, these tickets are collected and footed, giving an accurate record of the moist tonnage delivered to each battery or crushing machine.

Sampling is effected by an apron or door between the feeder chute and the crushing machine. At regular intervals (variable at will) this apron, thrown by a solenoid governed by an electric clock or controller of standard design, diverts the ore stream for any period of time desired. The sample so taken falls into a receptacle or on a conveyor belt, and is cut down and prepared for assay in the usual manner. Though not pertinent to the subject of this article, this method of handling mill feed has other advantages, as Mr. Ross remarks. In efficiency tests, etc., the work of one crushing machine may be checked against another; the machines may be more closely watched as to their individual performances; and at a mill treating custom ores, ores from different mines, or ores the treatment of which calls for certain definite mixtures, these mixtures may be readily made and

METALLURGICAL STATEMENT

ORE CRUSHED

1906-1907 Months	ORIGIN, TONNAGE, ASSAYS & CONTENTS																								DISTRIBUTION FOR TREATMENT																							
	Ore from Mine									Ore from Dump								Ore from Dams								Total Ore Crushed								To Concentrators								To Amalgamating Pans								To Cyanide Plant Direct							
	Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents			Tons Dry	Mill Assays				Contents			Tons Dry	Mill Assays				Contents			Tons Dry	Mill Assays				Contents			Tons Dry	Mill Assays				Contents			Tons Dry	Mill Assays				Contents		
		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.

varied as wanted, precisely as in smelter charges.

Automatic Tailings Sampler Best

If a determination of the tonnages of crushed material distributed to different departments is required, automatic time samplers, worked by an electric clock or controller, will give results most closely approximating the facts. The sample of the final mill tailings should be taken by an automatic time sampler. If the flow from the plant is intermittent, as from some types of vacuum and pressure filters, the pulp should be dumped into a tank of ample capacity to handle the surges at each cycle, equipped with some suitable device for maintaining a regular and continuous discharge. I understand that at Santa Gertrudis (Pachuca) the Merrill press residues are sluiced into a Dorr thickener, the continuous underflow from which is sampled. This would appear to be a satisfactory procedure, as it furnishes a proper sample and at the same time clarifies the return water.

FIG. 2. TREATMENT DATA FOR THE MONTH OF ....., 191..

			Year to Date	
Crushing:		Oz.	Tons	Oz.
The batteries ran .... hours, or .... % of a possible ...., figured on a ....-stamp basis.				
The ore crushed, its origin, assays and contents, are as follows:	Tons	Oz.		
Surface ore	..... @			
Ore from old dumps	..... @			
Mine ore:				
100 level, N. stope	..... @			
200 level, S. stope	..... @			
300 level, S. stope	..... @			
Total ore to mill	..... @		.....	.....
Held in bins	..... @		.....	.....
Total ore crushed	..... @	.....	.....	.....
Crushed per stamp per 24 hours running time, ... tons.				
Tailings treatment:				
Tailings from dams, passed through classifier, etc	..... @	.....	.....	.....
Total material treated	..... @	.....	.....	.....
Concentrating:				
The Wilfley tables ran .... hours, or .... % of a possible ...., figured on a ....-table basis.				
Concentrates produced, ... tons @ .... oz.		.....	.....	.....
Recovery by concentration, ... % of total contents, or .... oz. per ton of mill feed				
Fine grinding:				
The tube mills ran .... hours, or .... % of a possible ...., figured on a ....-mill basis				
The tube mills delivered to the cyanide department, net .... tons of finely ground material, averaging .... oz., and containing		.....	.....	.....
Cyaniding:				
Stock of silver in mill per previous report		.....		.....
Total charge to cyanide department		.....		.....
The agitators handled .... charges, of varying density.				
The filter was operated for .... cycles, or .... % of a possible .., discharging .... tons of residues averaging ..... oz., or ..... oz. per ton of mill feed, and accounting for ..... oz.			.....	
Solutions, pulp, zinc, etc., were on hand at close of month, estimated as containing ..... oz.		.....		.....
The indicated recovery by cyanidation was .... % of total values entering mill, or .... % of agitator heads, being .... oz. per ton of mill feed, or .... oz. per ton of charge; gross		.....		.....
Cleanup and melting.				
This department handled .... tons of precipitate, assaying .... oz. per ton, or about .... fine, and produced bars .... to .... inclusive, weighing crude .... oz., average fineness, ..., total fine ounces		.....		.....
Deducting silver produced from remelting former by-products	Oz.			
and adding .... byproducts held for future remelting	.....	.....		.....
The actual bullion recovery appears as		.....		.....
The indicated bullion recovery being, as above		.....		.....
The apparent overclean (or underclean) is		.....		.....

Metallurgical results:		Oz.	%	%	Oz.
Recovery, *indicated:*	Concentration	.....	.....	.....	.....
	Cyanidation	.....	.....	.....	.....
	Total indicated	.....	.....	.....	.....
Recovery, *obtained:*	Concentrates	.....	.....	.....	.....
	Bullion, etc	.....	.....	.....	.....
	Total obtained	.....	.....	.....	.....

		Lb.	Lb.
Sodium cyanide (125–130%) consumed:	Per ton treated	.....	.....
	Per ounce recovered	.....	.....
Zinc consumed:	Per ton treated	.....	.....
	Per ounce recovered	.....	.....
Lime consumed:	Per ton treated	.....	.....
	Per ounce recovered	.....	.....
Pebbles added:	Per ton ground	.....	.....
	Per ounce recovered	.....	.....
Crushing and grinding parts renewed: (Specify battery or tube mill)	Per ton crushed or ground	.....	.....
	Per ounce recovered	.....	.....

Whatever the sampling, weighing, and assaying methods may be, the data obtained from them are part of the general mine accounting, and should be assembled and compiled in the manager's office from day to day, for transfer to the metallurgical balance at monthly intervals. In this work (as well as in a variety of metallurgical and engineering calculations) the use of a Brunsviga calculating machine will be found most advantageous, as insuring accurate computations with a minimum of clerical staff. There may be other machines of equal speed and accuracy, but the Brunsviga is a simple, portable device, and has the great advantage of substantial construction and comparative freedom from the necessity of repairs. At mines far from repair shops and mechanics expert in fine machine work, this is a most valuable feature.

Tabulated Forms Convenient

To illustrate the method of accounting suggested, I give herewith a tabulated form (Fig. 1) which was introduced by me several years ago into the metallurgical records of a well known Mexican mine, arranged to suit conditions ruling at the time. It will be noted that it provides for concentration, amalgamation, and cyanidation; and, as the residues from the two former operations were ultimately delivered to the cyanide department, the division showing metals in mill at cut-off, headed "In Suspense," appears only under "Ore Cyanided." If tonnage were held back in the amalgamation and concentration work, similar divisions would be introduced into the respective tabulations, the total metals in suspense in the mill being obtained by combining the figures appearing in the three divisions. At few mills, however, is the treatment such that this would be necessary.

It is practically impossible to estimate in detail (by sampling, measuring, and assaying), with even a reasonable degree of accuracy, the metals existing at any determined moment of cut-off in a modern agitation mill in continuous operation, with agitators, thickeners, excess-pulp tanks, solution tanks, zinc boxes, etc., all more or less charged with materials of different character and value. At such a mill, moreover, to shut down and clean up monthly is not even to be thought of. The information required in order to form an approximate judgment as to whether the plant is really turning out the metals called for by the daily records must be sought in some other way.

It requires little foresight, and involves no particular inconvenience, to arrange the treatment so that the tonnage in suspense at cut-off does not vary materially from month to month. If the grade of the ore treated is not subject to wide fluctuations, observation of the balances appearing in the "In Suspense"

column will give as close a check on the actual recovery as can be had without a cleanup. After the first couple of months, these balances will reflect closely the state of affairs in the mill, as regards checking of actual recovery with the theoretical figures. If the mill is doing close work the balance will be nearly constant from month to month, whereas any shortage or overrun of importance will be shown by an increase or decrease of the balance figures. If closer watching is required, the cut-off must be more frequent; but this might involve too much work except in extraordinary cases, or at mills which ship unmelted precipitate.

The "In Suspense" column of such a statement should receive the careful attention of the mines manager, and any variations not accountable for by difference in grade of ore in mill at cut-off, imperfect cleanup as compared with usual practice, or other causes which will suggest themselves, should receive prompt investigation. As in every other business, the only way in which a correct inventory of stock on hand can be obtained is to take one. At least once a year, the balance appearing as in suspense should be verified by a general cleanup, which may be combined advantageously with an overhauling of the mill. Few plants are kept in such operating condition that an occasional overhauling will not improve their work; and advantage may be taken of this repairing to check the production definitely, without undue loss of running time.

Records Based on Mill Assays Alone

The metallurgical balance-sheet should be prepared from mine assays of crude ore and products, no consideration being given to assays of smelters or refiners to whom the products are sold. With reasonable care and diligence, sampling and assaying can be done as accurately at the mine as at the refinery, and where there is a conscientious effort to ascertain the exact metal contents of shipping product, on the part of the mine force, I should be inclined to support their results as against the average smelter returns. From the nature of the operations, however, differences between mine and smelter assays are inevitable; but as they occur in the selling of the product, and are linked with differences in metal prices as between mine estimates and smelter returns, I prefer to consider them in a correction statement forming part of the general business accounting of the concern, of which the metallurgist should receive a copy.

It has been my experience, also, that marketing the product of a mine or mill very frequently suffers from laxity and imperfect knowledge on the part of agents, banks, and others to whom it is consigned for realization. After all, selling the product of a mine does not differ materially from selling that of a farm or factory—the ablest salesman gets the best of the deal, even in assays, and there is no valid reason why the record of a good metallurgist, doing efficient work at a plant, should be charged with losses arising from deficient marketing ability on the part of a selling agent.

At certain mines where the treatment is simple and the conditions admit of a close estimate of the quantity of metal in the mill at cut-off, a statement along the lines of the second form (Fig.2), combining the production account with sundry other milling data, might be preferred. A form of this kind was used by me, while manager of an isolated Mexican property, and served at the same time as part of my monthly report to the head office. It will be noticed that in addition to data concerning the work of the month, the form shows also totals for the year, up to the date of report, of such items as tonnage and contents of mill feed, concentrates, precipitate, bullion, tailings, etc. As used, it was typewritten; but a properly printed and ruled form, with additional columns at the right for cumulative figures covering whatever other treatment data might be required, would be found much more convenient to prepare.

While the arrangement of these metallurgical statements is defective in certain particulars, they will serve to illustrate the desirability of a method of checking actual production with indicated recovery of metals. With the necessary alterations and additions to fit individual cases, they will be found useful (and sometimes very enlightening) at many mines where the cyanide process is in use.

Development at Collahuasi, Chile

By Manuel C. Gonzales*

The name of the company formerly known as the Cia. Minera de Collahuasi,—La Grande has been changed to Société Françaisé des Mines de Cuivre, Collahuasi, La Grande. This is a stock company with a capital of 15,000,000 francs. The home office is 43 Boulevard Haussmann, Paris, France; there is also an office at Iquique, Chile.

The water level has been reached in most of the mines of the company, and there appears to be an abundance of sulphide ores composed of the minerals covellite, chalcocite and chalcopyrite. The work of development at the principal mines assures a continuance of the present rate of shipping export ore, 3000 metric tons per month, for a long time. The export ore contains not less than 25% copper.

There are reserves of low-grade ores amounting to 250,000 tons assaying 9% copper, 12 oz. silver and 8 grams gold per ton, and the quantity of bonanza ore that was left in backs and pillars probably amounts to 100,000 tons containing from 21 to 25% copper.

It is expected that a number of aerial tramways will be built to connect the different mines with the railroad station that connects the district with the port of Antofogasta.

The Collahuasi company is planning to build a concentrator of 500 tons daily capacity in the Huiquintipa gulch. It is probable that ores from other mines in the district will be sent to this mill for beneficiation.

The development of a large tonnage of low-grade sulphide ore has caused the directors to consider building a smeltery. Water-jacket furnaces and basic converters will be used. If the mill and smeltery are built a large number of mines that can produce low-grade ore will be able to resume production. At present the ore cannot stand the high tariff for transportation to the coast by rail.

*Mining engineer, Casilla 326, Iquique, Chile.

Magnesite Deposits in Venezuela

Special Correspondence

On the Island of Marguerita, near the northern coast of Venezuela, deposits of magnesite of good quality are found in layers or strata of unknown thickness. The main deposits are about a mile from the port of Porlamar and three miles from the port of Pambatar. These ports are accessible and good for vessels of any draft.

Magnesite is not considered by the mining laws of Venezuela as a mineral, properly speaking; that is to say, the exploitation and exportation of magnesite do not require the holding of mining patent or the like, as would be the case with other minerals, but the owner of the land can freely make use of magnesite, just the same as any other product.

According to executive decree of the government of Venezuela, dated May 11, 1908, magnesite and other similar substances shall pay as land taxes, one bolivar (about 20c.) per metric ton. An analysis of an average sample gave: Magnesia, 46.34%—equivalent to carbonate of magnesia, 96.94%. One American company is now shipping from these deposits and other American interests are engaged in explorations.

Manganese peroxide is used as an oxidizer in the manufacture of chlorine and oxygen, and of potassium permanganate, as a drier in paints and varnishes, as a decolorizer of glass and in the manufacture of dry batteries and Leclanche cells. As a coloring material, manganese is used in coloring glass, brick and pottery. Several manganese salts are used in drying cloth and as paint.

Gloomy Outlook on the Rand

Johannesburg Correspondence

Mismanagement at some mines, lessened profits due to lowering of the grade of ore at others and failure of certain milling operations have engendered distrust, making it difficult to raise necessary capital for present operations or for financing new undertakings.

The outlook for 1912 on the Rand is by no means bright, and one of the signs of depression is the fact that the Central Mining & Investment Corporation ("Ecksteins," or the "Corner House") has decided to engage in no new work for some time, and has dismissed its chief mechanical and electrical engineers, and about 20 others, including draftsmen. There are generally a lack of confidence and acute disappointment among investors that make it impossible at present to raise money for new schemes and to complete existing enterprises.

The reasons for this state of affairs are unfortunately numerous. The case of the East Rand Proprietary mismanagement I have already dealt with. It was the case of a mine boomed as capable of paying 40% dividends for 40 years, when it was well known that developments in the Angelo Deep portion of the mine showed, to say the least, an alarming increase in the percentage of "unpayable ore" in the lower levels. Shares which stood a year ago at £5 can now be purchased for half that sum, and a debenture debt of £1,500,000 and £300,000 more capital must still be raised.

Poor Results at City Deep Mill

To this must be added the disappointment experienced at the City Deep mine. This mine was hailed as one of the genuine mining prizes of the Rand, and no money was spared to make the surface equipment the finest and most modern in the world.

It is stated that £50,000 were spent on tram lines, embankments, trestles, etc., connecting the shaft and mill. The steel and concrete design of the mill was heralded as the last word in mill construction and the whole mill was electrically driven. Since then, I believe, an auxiliary steam plant was laid down, adding largely to the cost.

As soon as this new mill started, troubles commenced. Vibration was excessive, the tops of the cast-steel casting vibrating, it is said, ⅛ in. The Laschinger patent camshaft bearings acted well, except for the shearing of some small studs or bolts, due to the vibration; but the exceedingly long heads caused trouble, the guides placed on top of the boxes being ineffective. These heavy heads gave trouble because the adhesion between them and the stems, despite the degree of taper given, was often insufficient. Also the shanks of the shoes showed a tendency to break off. The cast-steel frame, which held the Laschinger bearings, was bolted to the tops of the concrete king posts. Owing to the vibration, this frame started cracking and had to be patched in many places.

Many Alterations at Mill

I believe I am right in saying that a portion of the mill has been practically rebuilt as regards the battery framing and that the weight of stamps has been reduced by shortening the heads. The most striking commentary on the success or failure of the mill is that in the mill recently erected on the Modder B. mine, this design has been abandoned and wooden king posts have been reinstated. These facts have not hitherto been made public, and the design of the mill is believed to have been successful.

These alterations have caused enormous expense, but there appears to have been trouble in the mine also. A distinguished engineer, when he last visited the Rand, protested against the practice of calling ore developed, when it was merely driven under. It is believed that he referred to the City Deep. Certain statements were made before the mill was completed as to the amount of ore developed, but this ore was not cut up into blocks ready for stoping, as it was proposed to work the mine on some new scheme. The mine was not apparently in a position to produce the tonnage anticipated, and its performances have so far been most disappointing.

Mine Management Changed

The whole system of management of the mine has been reorganized, the consulting engineer being changed and two managers being dispensed with in rapid succession. Shares have fallen from £4 to near £2, and the mine is in debt to an unknown amount. Shortage of labor was advanced as an excuse for nonfulfillment of program, but the causes lie deeper. Fortunately the quarterly development results continue to show reefs of good width and value, and the mine is undoubtedly a fine one at the present depth. The first level was driven over 10,000 ft. on a rich section of the main-reef leader.

The falling off in grade of the Main Reef West mine furnished a disappointment, and shares fell heavily because of poorer development results and reduced grade and profits. Capital expenditure on the large Randfontein Central mine, having exceeded anticipations and the mine having failed to supply the new 600-stamp mill with ore, the shares have also fallen. Shortage of labor is said to be the cause for this failure.

The older mines of the Randfontein South have small shafts and the workings are becoming deeper, causing greater trouble in hoisting. The opening of some parallel reef bodies lying to the west of the Randfontein reefs which show payable ore is the bright spot in this connection. The West Rand Consolidated, on which it was at one time proposed to erect 1000 stamps, has, so far, showed low-grade ore, and small profits from the 80-stamp mill already erected. Shortage of labor and the need of extra capital for an enlarged scheme of operations have proved a serious drawback, but the capital of the mine is already large and the grade of the mine appears to be lower than anticipated.

The policy of centralization and reorganization adopted in connection with the large Crown Mines amalgamation has taken longer to perfect than anticipated, and here again capital expenditure has exceeded expectations. No special information is made public as to the development results in the lowest workings, but as far as known ore above the average grade is being mined at present, to repay capital expenditure. In the rich Ferriera Deep mine, the grade and profits have fallen, as the result of bad mining in the past. About 400,000 tons of tailings were sent down to pack stopes to secure them and the shaft. Several rich stopes have become inaccessible for a time, owing to movements of ground.

Gloom in the Germiston District

The most gloomy outlook is furnished by the deep mines of the Germiston district. Of these, the Simmer East, on which nearly £1,000,000 was spent, has passed into the hands of the debenture holders. The occurrence of faults and dikes, and of ore under the average grade of the outcrop mines above produced this result. A working profit of a few thousand pounds per month was made, but not enough to repay debentures and provide interest. Over a year ago the consulting engineer of the Consolidated Gold Fields made the admission that the grade to be expected from the Jupiter and Simmer Deep mines, working the reef between 3000 and 5000 ft. on the dip of the celebrated Simmer & Jack mine, was not more than 5 dwt. per ton, and the last quarterly reports of these mines show what such a grade means in profits at that depth.

The Jupiter mine reported 2368 ft. of development work and this footage only allowed of 14,652 tons of payable ore be-

ing described as fully developed. There were 92,100 tons crushed, at a cost of 18s. 5.7d. per ton, showing a working profit of 2s. 0.4d., or a total of £9350. Capital expenditure on plant and buildings absorbed £22,137, and shaft sinking, £8657; development, £7815; but development account was charged £8969 to working cost. From these figures, the mine appears scarcely to be making any real profit, let alone paying for capital expenditure. On this mine over £1,000,000 was spent.

The Simmer Deep reported 3180 ft. of development, exposing 167,830 tons of ore presumably of payable grade; 146,700 tons were crushed at a cost of 15s. 11.7d. per ton, but the grade was so low that the profit was only 1s. 2d. per ton. The total working profit was £8582, but interest and debenture redemption absorbed £13,956 and capital expenditure £2407. The estimated loss, profit tax included, was £3799 for the quarter. On perusing these figures, one is led to ask if these mines can keep running under present conditions. Apparently development results are not improving and the outlook here is certainly not encouraging.

Losses from Poor Ore and Labor Shortage

The Knights Central is meeting with poor ore in depth. The water, which used to trouble the Knights Deep, now troubles the Witwatersrand Deep, and pumps to deal with 3,000,000 gal. per day have had to be installed. Development in the lower levels continues good.

Owing to shortage of labor, the Cinderella Consolidated has abandoned raising ore from its deep workings on the dip of the reef below the bottom of the 4000-ft. vertical shaft. What the real position of this deep-mining venture really is, is not known publicly, but shares have fallen.

The East Rand Extension, Boksburg and Van Dyk mines are closed down, owing to poor development, and work has been greatly restricted on the Rand Collieries, where the reef has proved erratic in gold content, and required a large further capital expenditure to bring it to the producing stage. There are about 2,500,000 tons of payable ore fully developed.

Trouble at Benoni Mill

The Benoni mine is in a serious position. So far, the Way-Arbuckle slimes plant seems to have proved a failure. Alfred James predicted the failure of the screw slime elevators, and centrifugal pumps appear not to have been a success. The extraction obtained from the first operations was poor and the ore is of low grade, so that at present the mine is heavily in debt and may have to close down.

The Apex mines, developing on the dip, have almost exhausted available capital and may close down also. The Randfontein Deep mine has stopped shaft sinking and closed down, owing to water difficulties and the need of raising fresh capital.

Some Bright Spots

The bright spots of the picture are not plentiful. The Brakpan mine has started work and is giving favorable results. Steady development work is going on at the Van Ryn Deep, the State mines, the Modder Deep, the Rand Klip, the Springs and Daggafontein mines. The New Modderfontein and the Modder B. mines continue to give excellent returns. The Modder B. mine has started its plant without any hitch, and the grade of ore mined has been excellent.

A large number of old outcrop mines that have been steady producers for 25 years are rapidly approaching the end. The Salisbury and Jubilee mines and the Geldenhuis closed down in 1911, and the York mine, Champ d'Or, Ferreira, Spes Bona, Jumpers, Glencairn, May Consolidated and Treasury are nearly worked out, and several will close down in 1912. The prospects for 1912 are somewhat clouded, owing to the cessation of work on development mines, the difficulty of raising fresh capital, the fear of further legislation on the eight-hour day and other questions, including compensation for miners' phthisis.

Motor Trucks for Mines

Although the work of hauling to be done at most mines is over rough roads and under unusually severe conditions the gasoline-motor truck is in some districts beginning to displace both the horse and the mule. In desert regions, where the conditions are disadvantageous for making records, the motor truck is being introduced. It has one paramount advantage over draft animals under such conditions in that no water has to be carried for drinking purposes. Water holes in the desert are usually far apart, and the substitution of the motor for the draft animal would be warrantable for humane reasons if not for economy.

One instance of the use of motor trucks at mines is the Mack truck recently purchased from the International Motor Co., by the Jersey Valley Mines Co., for use in hauling supplies to its property near Battle Mountain, Nev. It is shown in the accompanying illustration. The first trip made by this motor was over a desert road. A drag of two 9-ft. lengths of 90-lb. rail was fastened behind the motor and dragged for 46 miles to smooth the ruts from the road that had been made while hauling freight by mule wagons. A gang of four men followed the drag to remove loose stones. This motor is making the 92-mile round trip in 16½ hours running time; 9½ hours going out with a full load of 15 tons and returning empty in 7 hours. The time taken by a 12-mule team for a 6-ton load was three days going out and two days returning, not including the one day's rest between trips.

Motor Truck of the Jersey Valley Mines Co., Near Battle Mountain, Nev.

Another company using the motor truck is the Pioneer Smelting Co., which has a smeltery near Tucson, Ariz. It is using a Saurer motor truck that carries 6½ tons of ore at a trip. After having traveled 1730 miles the solid rubber tires show little wear. The motor travels 94 miles per day using 1 gal. of cylinder oil and 20 gal. of gasoline. It transports about 40 tons of ore daily over a distance of 7¼ miles.

Tasmanian Mineral Production in 1911

The Secretary for Mines for Tasmania has already issued his report for the 1911 production. This is as follows, the items standing in order of descending value: Tin ore, 3953 tons; blister copper, 6022; silver-lead ore, 61,501; gold, 31,101 oz.; coal, 57,067 tons; copper ore and precipitate, 2286; wolfram, 70; bismuth, 15; osmiridium, 272 oz. (valued at £1888); and shale, 500 tons. The 1911 mineral production is valued at £1,349,497, as against £1,432,193 for the previous year.

Air in Pyritic Smelting

By E. W. Walter*

Experience indicates that a silicious skeleton at the tuyeres is not essential to maximum oxidizing effect, that impure air is detrimental and hot blast in partial pyritic smelting is advantageous as the smelting capacity is increased and profits augmented, although no greater degree of concentration is effected.

*Mining engineer and metallurgist, Silverton, Colo.

In the practice of pyritic smelting, it was early noted by several metallurgists, particularly Herbert Lang, that the vital principles rested on three main features: (1) A large volume of air to oxidize the pyrite, with consequent development of heat. (2) The presence of sufficient free silica to flux the ferrous oxide formed. (3) The curtailment of coke to the greatest extent possible to permit oxidation of the pyrite by the air.

The Bessemerizing Action

Great stress was initially laid, by metallurgists reasoning from an academic standpoint, upon the advantage of a large volume of air at very low pressure, and even fan blowers were advocated for such conditions, in the belief that pyritic-furnace oxidation rested in slow gradual roasting of the sulphides from the top of the furnace charge to fusion zone. In actual practice it was soon discovered that to deliver the volume of air necessary for pyritic effect, the furnace resistance had to be overcome, which called for pressure. With volume and pressure came the marked activity of oxidation and the abandonment of the slow roasting explanation of pyritic effect, to the one of bessermerizing action. In this sense, the easily fusible pyrite melting in the upper zones of the furnace shaft and trickling downward, is met by the oxidizing blast and converted into ferrous oxide, which in turn seizes with avidity the adjacent free silica from the quartz in the charge and from a certain silicious skeleton formed in the lower furnace shaft from former charges.

Silicious Skeleton not Essential

It has been repeatedly expressed by many metallurgists that the highest oxidizing effect of the blast is obtained, only after the tuyere zone has become encrusted with this sponge-like silicious skeleton, whereby the blast volume is broken into innumerable streamlets of highly-heated air from its passage through this porous skeleton, and further that this skeleton is being added to or taken from according to the requirements for silica of the ferrous oxide produced. George A. Guess in his article "Notes on Pyritic Smelting" published in the JOURNAL of Jan. 13, 1912, doubts the necessity of such furnace conditions at the tuyere zone, and cites most excellent concentration without such silicious skeleton. My own experience is in perfect accord with that of Mr. Guess. Such conditions at the tuyere zone, are not, in my opinion, the essential requirements for pyritic smelting, but rather the effect of the cooling influence of the large volume of blast, which must necessarily become heated to perform its function, and in so doing, cools the tuyere zone, forming the skeleton in question. This is proven to my mind, by the fact, that this skeleton is constantly changing and particularly so when blast pressure is altered, and is therefore only incident to the operation of the process and not particularly the necessary factor.

Rapid Smelting and Heavy Matte Fall Essential

The bessermerizing effect on the trickling drops of matte descending from the upper zones is one that is continuous from the moment of formation, but reaches its highest effect in the incandescent zone, at which point the furnace is at its greatest endeavor. At this point the final degree of oxidation with consequent heat is developed and the partially formed slag from the upper zones completed. The success of the whole operation rests with the culmination of this last oxidation in this zone; air volume, air pressure, free silica and trickling matte must be harmoniously computed to bring about the acme of reaction and activity, and any disturbance of any of these essentials will soon show effect both in the matte and slag produced. It follows, to meet these conditions in actual practice, that the furnace charge should not be dense to a degree that will retard the blast nor contain elements which would raise the fusion temperature much above that of the simple singulo-silicate slag; rapidity of smelting with the charge constantly dropping, together with a heavy matte fall are essential for success.

There are, however, few places in the world where conditions are suitable for pyritic smelting using say from 1% to 4% coke, but almost all copper furnaces are smelting on pyritic principles, using say from 6% to 10% coke, depending upon the amount of pyrite in the ores. With such operation, the purity of the ores as well as their physical character, so essential in the practically true pyritic smelting, are of more or less minor importance, but the volume and pressure of the blast still maintains a premier position.

Heated Blast Advantageous in Partial Pyritic Smelting

While it is generally agreed that heated blast in true pyritic smelting offers no particular advantage, due to the fusibility of the charge, yet in semi-pyritic smelting due to the higher temperature required, heated blast is of great advantage. An extensive experience with both cold blast and blast heated to a temperature of 500° F. showed that, in the same furnace with the same ores, such remarkable betterment both from an operating and profit-earning standpoint, was produced by the heated blast that I feel assured that its advantages have not been thoroughly recognized. A comparison of hot- and cold-blast smelting is given as follows, prepared from data taken from records of an actual performance. The necessity of repairing the blast stoves afforded the opportunities for making the comparisons.

With cold blast 107 tons of ore were smelted with 15% or 16.05 tons of coke, which at $7 per ton cost $112.35; with hot blast, 154 tons of ore were smelted with 7% or 10.78 tons of coke that cost $75.46. The hot blast effected a saving of 5.27 tons of coke, or $36.89 for fuel expense; the capacity was increased 47 tons which at $4 per ton for treatment increased the receipts for the period by $188. The costs of operating the hot-blast stove and extra limestone required were $38 and $6.60 respectively, so that the profit made by hot-blast smelting was $180.29 more than when cold blast was used. The test was of 24-hr. duration, the hot blast had a temperature of 500° F., the matte and slag were the same in both cases, all other conditions were identical; the ore was a silicious sulphide.

Heated Blast Does Not Increase Concentration

It will be noted, that matte and slag produced is stated as the same, which perhaps requires some explanation in light of the general belief that heated blast would have the effect of increasing the concentration. Contrary to this belief, my experience has been, that heated blast exerts itself not to increasing the degree of concentration, but rather to expending itself in smelting more charge. The reason for this is that the smelting furnace is relieved of part of the duty of preheating the blast, the fusion zone is lower, and the whole furnace cross-section active by reason of the absence to a large extent of the silicious skeleton

around the tuyere zone, thereby enlarging the active zone of incandescence.

With ores containing elements such as alumina and zinc and depending on the sulphides oxidized by the blast to furnish ferrous oxide for the slag, heated blast certainly is of great advantage, bringing about smoothness of operation and producing slag impossible with air at normal atmospheric temperatures.

That the blast entering the smelting furnace should be pure, uncontaminated air, was forced to my attention some years ago, while conducting some smelting experiments with blast heated to a temperature of 900° F. The blast was preheated easily and quickly by coke in an apparatus that I do not feel at liberty to describe. The products of combustion, almost entirely carbon dioxide, contaminated the air. The smelting furnace was of excellent design and for the work intended required 10,000 cu.ft. of air per minute. A short calculation amply verified by gas analyses during the experiment will show the conditions.

Taking 13.1 cu.ft. air as equal to 1 lb., 10,000 cu.ft. equals 763 lb. The specific heat of air is 0.24, therefore 0.24x763x 900=164,808 heat units are required. The coke used contained 76% carbon and was equal to 11,020 heat units per lb. Therefore 14.9 lb. of coke was required to heat 763 lb. of air to 900° F. and as 14.9 lb. coke contain 76% or 11.5 lb. carbon, and 1 lb. carbon burned to carbon dioxide requires 2.667 lb. oxygen, 11.5 lb. carbon requires 30.67 lb. oxygen. As 763 lb. air contain 175.5 lb. oxygen, therefore, 17.4% of oxygen efficiency is lost in preheating. In replacement there are 42 lb. of carbon dioxide. In other words in place of pure unadulterated air, we had a mixture containing only 18.7% out of a possible 23% by weight of oxygen and further contaminated with over 5% carbon dioxide along with inert nitrogen.

Effects of Impure Air

In the experiment, the furnace was operating normally with cold blast, smelting a good tonnage and producing a fair-grade matte. The bypass for cold air was closed and the blast directed through the blast-heating apparatus. It was deemed best to make no alterations whatever with the charge, allowing the same conditions to prevail, and change only as conditions might necessitate. In the course of a half hour the blast had reached a temperature of 900° and was held at that point. Ordinarily a furnace with this temperature blast and with the same coke as with cold blast, should have "bullseyed" the tuyeres and run away, but quite the contrary happened, the tuyeres grew darker, the slag colder, the jackets became crusted and matters became so doleful, that a return to cold blast became imperative to save the furnace. A slight increase of fuel and pure atmospheric air soon put matters aright, when the experiment was repeated with identical results.

From experiment along these lines, I feel thoroughly convinced that any contamination of the air furnished the furnace will result in bad effects and mitigate against smooth operation and results. This is not surprising when it is considered that the air is delivered directly to the fusion zone, where the final oxidation is at stake and where oxygen is required to fulfill requirements and where any deficiency will show marked effect. To replace such necessary oxygen even to a small extent with an extinguishing gas such as carbon dioxide must certainly bring about deleterious results. It is a matter of considerable doubt whether any method of preheating which will in any way contaminate the air will meet with such success as marks the energy of pure unadulterated air.

Jarbidge, Contact and Elk Mountain Districts, Nevada

As the result of a geologic field examination made in 1910 by F. C. Schrader, in Elko County, Nev., the U. S. Geological Survey has published a report on the Jarbidge, Contact, and Elk Mountain mining districts. The area comprising these districts is about 35 miles long and 26 miles wide and covers about 1400 square miles. It lies in the northeastern part of the region known as the Nevada Plateau, at a general elevation of about 6000 ft., including parts of the Great Basin on the south and the Snake River valley on the north.

The first gold ore discovered in the Jarbidge district is reported to have been found in 1904 by a sheep tender, but the discovery that led to the founding of the present district was made in 1909. The developments are encouraging and the district as a whole is said to be fulfilling the promise of its surface showings. In some of the analyses of ore large percentages of potash were also determined.

The ores of the Contact district are almost wholly copper ores, but they contain also small amounts of silver and gold, and in some portions of the district lead, manganese, and zinc ores are found. The early prospectors searched for gold, but Mr. Schrader describes a number of copper properties that have been opened since 1887, many of them having been operated on a rather large scale. Railroad facilities are promised in the near future.

Mineral deposits were known in the Elk Mountain district as early as 1890, since which time work has been carried on there each year, though the district as a whole is still in the prospect stage. The chief metal of this district is copper, and gold and silver are associated with it.

Florida Phosphate Production

The fourth annual report of the Florida Geological Survey, by E. H. Sellards, shows that the production of phosphate rock in Florida during 1911 was 2,494,572 long tons as compared with 2,029,797 long tons in 1910. In 1911 the production of hard rock was 474,095 and of pebble rock, 2,020,477, while the 1910 production was 392,088 and 1,637,709 long tons, respectively.

The total domestic shipments of phosphate rock during 1911 were 1,290,779 tons; while during 1910 the domestic shipments amounted to 1,014,473 tons, from which it appears that slightly more than one-half of the phosphate produced in Florida is consigned to points within the United States.

Operating Companies

In all, 31 companies were engaged in mining phosphate in Florida during 1911. A list of phosphate companies operating in Florida during 1911 is given herewith: Armour Fertilizer Works, Bartow, Fla.; Peter B. & Robert S. Bradley, 92 State St., Boston, Mass, and Floral City, Fla.; J. Buttgenbach & Co., Holder, Fla.; Camp Phosphate Co., Ocala, Fla.; Central Phosphate Co., Dutton, Fla.; Charleston (S. C.) Mining & Manufacturing Co., Charleston, S. C., and Ft. Meade, Fla.; Compagnie Generale des Phosphates de la Floride, Pembroke, Fla.; Coronet Phosphate Co., 99 John St., New York, and Lakeland, Fla.; Cummer Lumber Co., Jacksonville, Fla., and Newberry, Fla.; Dominion Phosphate Co., Bartow, Fla.; Dunnellon Phosphate Co., Rockwell, Fla.; Dutton Phosphate Co., Gainesville, Fla.; Florida Mining Co., 165 Broadway, New York, and Mulberry, Fla.; Florida Phosphate Mining Corporation, Norfolk, Va., and Bartow, Fla.; Franklin Phosphate Co., Newberry, Fla.; Germofert Manufacturing Co., Charleston, S. C., and Jane Jay, Fla.; Holder Phosphate Co., Ocala, Fla.; International Phosphate Co., 27 State St., Boston, Mass., and Ft. Meade, Fla.; Interstate Chemical Corporation, Bowling Green, Fla.; Istachatta Phosphate Co., Istachatta, Fla.; Mutual Mining Co., Savannah, Ga., and Newberry, Fla.; Palmetto Phosphate Co., Baltimore, Md., and Tiger Bay, Fla.; Phosphate Mining Co., 92 William St., New York, and Nichols, Fla.; Pierce Phosphate Co., 2 Rector St., New York, and Pierce, Fla.; Prairie Pebble Phosphate Co., 165 Broadway, New York, and Mulberry, Fla.; Schilman & Bene, Ocala, Fla.; Southern Phosphate Development Co., Ocala, Fla.; Standard Phosphate Co., Christina, Fla.; State Phosphate Co., Bartow, Fla.; T. A. Thompson, Neals, Fla. The Amalgamated Phosphate Co. began, in 1911, the construction of a plant for the production of pebble phosphate.

The High Grade District, California

By Algernon Del Mar*

There is a mining excitement or stampede, as it is called, to the High Grade district, in Modoc County, Calif. The district has been by some compared favorably with Cripple Creek, but so far neither tellurides nor phonolite rock has been found. The country rock is a brecciated andesite, the vein matter being silicified brecciated andesite and rhyolite. The veins are from a few inches to many feet in width, varying in value from thousands to the ton in the narrow veins to an average of, say, $12 in the veins about 4 ft. wide.

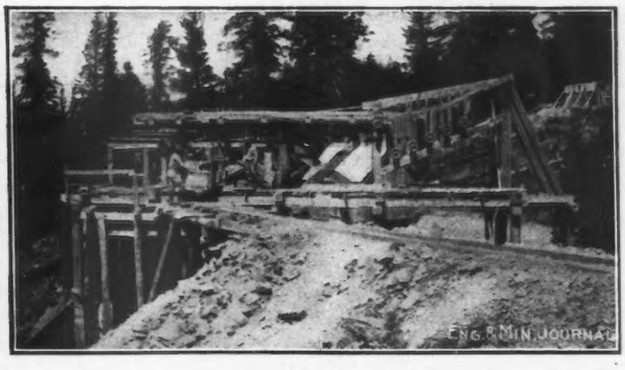
The district has been thoroughly prospected on the surface, and at least four properties have been developed for a few hundred feet underground. There is nothing to get excited about, nor is there any occasion for a stampede or a boom in the district.

This mineral area was last year known as the Hogue district, but has been renamed this year the High Grade district by some adventurous spirits, who will, no doubt, endeavor to be on the top of the rush. Snow covers the ground from November to June, often 20 ft. deep. New Pine Creek is the nearest railroad station, on the Nevada, California & Oregon, which makes connection at Reno with the Southern Pacific R.R. The district is in the northeast extremity of California; some of it is, in fact, in Oregon. Those who are determined to go there had better wait until July, but I would advise no one to go there expecting to make a fortune overnight. That the district may produce a few good mines is not improbable, but this ground is taken up and being worked by organized companies.

The Fort Bidwell Consolidated Mines Co. has a 10-stamp mill and an aërial tramway, erected by me last year. Winter overtook us before we were prepared to be snowed in, so that the mine was not well tested before closing down. With the addition of a cyanide plant, this mine should make good. A Lane mill was erected on the Fort Bidwell side of the mountains two years ago, but has never turned a wheel. There has been no ore for it to run on. The Big Four mine erected a mill last year, but winter came on before it was started. The mine is reported to be able to supply a large quantity of low-grade ore with the chances of high-grade streaks. The Sunshine mine shows a narrow vein of high-grade ore, from which the owners have been getting out enough for a shipment.

The district may be summed up thus: Narrow, rich veins not very numerous, and bodies of low-grade material not sufficiently developed to prove their worth as mining assets. California is hardly the place for a mining boom; the psychological phenomenon suits Nevada better, so it is quite an anomaly to see a rush to a California mining district. This district would have been developed in a business-like normal way, but for the fact that certain people have seen fit to overadvertise the advantages of owning a part of it.

*Mining engineer, Los Angeles, Calif.



Mill and Tramway of Fort Bidwell Consolidated Mines Co., High Grade District, California

Broken Hill South Silver

The Broken Hill South Silver Mining Co., in the half year ended Dec. 31, 1911, paid 4½%, besides writing off 5% depreciation on its plant. This was on a production of 181,562 tons of ore, assaying 14.4% Pb, 14.1% Zn and 6.9 oz. Ag. The concentrator treated 181,790 tons, from which were produced 27,339 tons of lead concentrates, assaying 71.9% Pb, 5% Zn and 24.5 oz. Ag; 123,969 tons of zinky tailings, carrying 16.7% Zn, 3.4% Pb and 3.6 oz. Ag; 10,571 tons of quartz tailings, carrying 2% Pb, 9.3% Zn and 1.9 oz. Ag; and 19,911 tons of slimes, carrying 9.8% of lead, 11.9% Zn and 5.4 oz. Ag. The Amalgamated Zinc (De Bavay's) took all the current zinc tailings, and 19,953 tons of the accumulated, and the Zinc Corporation took 5298 tons from the old tailings dumps.

It is estimated that there are 1,052,983 tons of tailings available for treatment by the Zinc Corporation, and 95,402 for De Bavay's, also 281,319 tons of accumulated slimes, while the ore reserves are at present estimated at 3,000,000 tons. The handling of the capital and plant account is conservative, and the profit and loss account stands at over 50% of the issued capital.

Working costs were: Mining, $2.60 per ton of ore; filling depleted stopes, $0.39; development, $0.30; and concentrating, $0.86; total, $4.15; equivalent to $27.39 per ton of lead concentrates.

The company is investigating a new process for zinc smelting, but no details of it are given.

Michigan Iron Ore Reserves

C. K. Leith, reports to the U. S. Geological Survey an estimated reserve in the iron mines of Michigan of 124,598,164 long tons of commercial ore and 44,982,938 tons in drilled areas, or a total reserve of 169,581,102 tons. This estimate leaves out of consideration high-silica, low-phosphorus ores of even 40% grade, which have been mined on both the Gogebic and the Marquette ranges.

The probabilities of extension in every district but the Menominee are said to be so strong that it is safe to estimate that for many years as much ore will be discovered as is mined. At present the reserve probably bears a larger ratio to the total shipment than at any time in the past, and the report states that in 10 years the proportion will probably be greater. Large extensions, both vertical and areal, are inevitable. Probably not more than 10% of the area of the upper Huronian slates of the Crystal Falls, Menominee, Iron River, and adjacent areas has been explored. The total known area of iron formation is stated to be 29,267 acres, but in addition there are fully 20,000 acres of magnetic belt in which exploration has scarcely more than begun.

The general conclusion of Doctor Leith's report is that in few other regions will expenditures for large explorations yield more certain results. There is yet no indication of diminishing returns from exploration. The reserve will cease to grow only when difficulties of exploration or outside economic influences begin to limit the amount of exploration.

Further Studies in Solution

By Harry C. Jones*

Certain salts are partially broken down by water into acids and bases; such hydrolytic dissociation is followed by electrolytic dissociation. Ions necessary for precipitation. Electrolytic dissociation an essential for chemical action. A change in intrinsic energy of the molecules the cause of chemical action. Why some mixtures of solids are true solutions.

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

A phenomenon of importance alike to the man of science and to the engineer is diffusion. If it did not exist in solutions it would be impossible to maintain a standard solution homogeneous for any length of time. The phenomenon of diffusion is so well known, that from sheer familiarity with it we are likely to underestimate its importance; just as from familiarity with water we are liable to forget that it is far and again the most interesting, remarkable, and many times the most important chemical compound known to man.

Think of the following fact. Take a tall glass cylinder and place over the bottom some heavy solid salt—say lead nitrate—then pour water carefully upon it. The salt will dissolve and rise through the much lighter water clear up to the top of the cylinder. If the cylinder is allowed to stand for a sufficient length of time, the solution will become homogeneous throughout its entire length.

This is in reality a remarkable fact. A heavy substance rising through a much lighter medium, apparently right against the pull of gravitation. It differs in degree but not in kind from the following. Indeed, it is quite analogous to our rising directly upward through the air.

Diffusion and Osmotic Pressure Related

The distribution of the salt throughout the entire length of the cylinder is what we call diffusion. It is true that hydration, or the power of the salt to combine with water may influence in some small degree its distribution throughout the solvent; but this is not the chief cause of the distribution.

Diffusion is but a name for a phenomenon or class of phenomenon. The question is: What is the cause of diffusion? If we study the laws of diffusion, on the one hand, and the laws of osmotic pressure on the other, we will find striking resemblances between the two. Thus, Fick's law of diffusion tells us that the amount of substance that will diffuse across any cross section between two solutions of different concentrations of any substance, is proportional to the difference in the concentrations of the two solutions. This is analogous to Boyle's law for gases.

We have already studied the "principle of Soret" for the temperature coefficients of diffusion, and have shown that it obeyed Gay-Lussac's law for gases, and the temperature coefficients of osmotic pressure conform to this same law.

So closely do the laws of diffusion conform to those of osmotic pressure, that we are now justified in concluding that osmotic pressure is the cause of diffusion. When we consider how important diffusion is in the various industries, we see how important a knowledge of the laws of osmotic pressure is to the engineer.

Hydrolytic Dissociation

We have seen in an earlier chapter how the theory of electrolytic dissociation arose and what it is. It is impossible in these short papers to give much of the evidence for it. A little of the evidence will, however, appear later. Suffice it to say, although it must under these conditions, be said dogmatically, that this theory has now become a law of nature, and is as well established as any of our ordinary laws of nature. It is now generally accepted by all productive chemists, and I know of no one of any marked reputation who doubts its validity.

There is, however, another kind of dissociation which must be referred to before leaving the subject of solutions as such. It is well known that an aqueous solution of sodium carbonate reacts alkaline. Why is this? The answer usually given is that it is because sodium is a strong base and carbon dioxide being a weak acid, the strong basic properties of the sodium predominate. This is nothing but words. Sodium is not a base at all. The only thing that has basic properties is the hydroxyl ion, and, therefore, the above so called explanation explains nothing. The above question remains, then, to be answered.

Why Some Salts are not Neutral

We have now the full explanation. Whenever a salt of a weak acid or a weak base is dissolved in water, the water acts upon the salt, decomposing it directly into the *free acid* and the *free base.* Take sodium carbonate; the water first acts upon it in the sense of the following equation—

$$Na_2CO_3 + 2\,H_2O = 2\,NaOH + H_2CO_3$$

We have free sodium hydroxide and free carbonic acid formed *at first.* These then undergo electrolytic dissociation in the following sense—

$$NaOH = \overset{+}{Na},\ \overset{-}{OH}$$

$$H_2CO_3 = \overset{++}{H,H},\ \overset{--}{CO_3}$$

Then the question arises, why do not the hydrogen ions of the acid just offset the hydroxyl ions of the base, and the solution react neutral? This is because the base is *strong,* ie., much dissociated. The acid is *very weak,* ie., only a little dissociated. We have many more hydroxyl ions present in the solution than we have hydrogen ions, and the solution, consequently, reacts alkaline.

If a salt of a weak base and a strong acid is dissolved in water, the water acts hydrolytically upon the salt, decomposing it into the free acid and the free base. The acid being strong is much dissociated, yielding many hydrogen ions. The base being weak is only a little dissociated; therefore, yields only a few hydroxyl ions. The hydrogen ions then predominate in such a solution and it reacts acid. This action of water in breaking down salts into free acids and free bases is known as *hydrolytic dissociation.* The products of hydrolytic dissociation are always electrolytically dissociated by the water to a greater or less extent, but this is a side issue.

Hydrolytic dissociation tells us, and tells us for the first time, why it is that aqueous solutions of certain salts react alkaline, and why it is that aqueous solutions of other salts react acid.

Colloidal Solution and Colloidal Suspension

We hear much today of colloidal solutions, colloidal suspensions, and in general, of "colloidal chemistry." What does this mean?

To understand what is meant by a colloidal solution we must ask again what is a true solution? Every true solution has the three fundamental properties of solutions—osmotic pressure, lowering of freezing point of the solvent and lowering of the vapor tension of the solvent. It is, however, not enough to possess these properties to be a true solution. They must be possessed to a certain definite degree. The osmotic pressure must obey the laws of gas pressure and be of the same magnitude as the gas pressure of a gas having the same concentration as the solution. The lowering of the freezing

point of the solvent must obey Raoult's law, i.e., one molecule or ion of the dissolved substance must lower the freezing point of 100 molecules of the dissolved substance about 0.63° C. Similarly, one molecule of the dissolved substance must lower the vapor tension (raise the boiling point) of 100 molecules of the solvent by a definite, known amount. These are the necessary and sufficient conditions for a true solution.

There are a number of substances which apparently dissolve in certain solvents and manifest all three of the above properties; but these properties are of a much smaller magnitude than indicated above. These are not true solutions, but colloidal solutions. Examples of colloidal solutions are starch, albumen, etc., in water.

The class in which we are especially interested here are the "colloidal suspensions." If arsenic chloride is dissolved in water and hydrogen sulphide conducted into the solution, we have yellow arsenic sulphide precipitated. If, on the other hand, arsenic oxide is dissolved in water and hydrogen sulphide conducted into the solution, we do not have any precipitate formed. The solution simply turns yellow.

In the latter case the arsenic sulphide formed is not precipitated and is not in solution. That this is not in solution is shown by the fact that it does not have any of the properties mentioned above as being characteristic of true solutions.

The arsenic sulphide formed from the arsenic oxide is in a state of colloidal suspension and is an excellent example of colloidal suspensions. Let us study briefly the properties of such a suspension.

If to the suspended arsenic sulphide an acid, base or salt is added, the arsenic sulphide is precipitated. Acids, bases and salts are the electrolytes. The addition of any electrolyte, then, causes a precipitation of the colloidal suspension. This is obviously a remarkable fact, and we must seek its explanation.

Colloidal Particles Charged Electrically

If we introduce two electrodes into a colloidal suspension and pass a current between them the colloid will collect around one pole, showing that the colloidal particles are electrically charged. Some colloids will collect around one pole and some around the other, but any given colloid will all move to one pole. This shows that some colloids are charged positively and other colloids negatively; but all the particles of any one colloid have the same kind of a charge upon them. This is a matter of fundamental importance and raises the question, how does the charge upon the colloidally suspended particles prevent them from clotting, or precipitating, as we say?

All of the particles of any given colloid have the same kind of a charge upon them. They, therefore electrically repel one another. When an electrolyte is added what takes place? If the colloidal particles in question are charged positively, the water around them is charged negatively. Where an electrolyte is added we add, of course, both positive and negative ions. The negative ions (anions) equalize the charges upon the colloidal particles, the cations equalizing the negatively charged water. Now what happens? The colloidal particles no longer repel one another electrically, at least to nothing like the original extent, and surface tension gets in its full effect. We have seen that the action of surface tension is to produce the smallest surface for a given mass. It draws the colloidally suspended particles together into large masses and we have what we call a precipitate.

Precipitation

This raises the whole question as to what is meant by precipitation in general, and precipitation is one of the most general chemical phenomena. We have precipitation in general only when ions are present, and for the reason pointed out above. If this seems strange, a moment's thought will show that it is not. When two substances are brought together which can react and form a solid that is insoluble in the solvent in question, they undoubtedly react in molecular quantities, molecule for molecule. The solid is first formed in a state of molecular aggregation, or at most only a few molecules are aggregated. These aggregates then still further aggregate until the condition of colloidal suspension is reached. These aggregates become charged electrically, the solvent taking the opposite charge, and further aggregation cannot go on—we have a colloidal suspension.

Colloidal Suspension the Natural Condition

This is, then, the natural condition of a solid when formed in a chemical reaction. It is only when we disturb the electrical equilibrium by adding electrically charged parts—ions—that the aggregating of the solid goes on and we have a precipitate. We are so accustomed to precipitates in chemistry, and they are so fundamental for both qualitative and quantitative analysis, that we are liable to look upon this condition as a matter of course—as the "natural condition" of matter in the solid state in the presence of a liquid. From what has just been said we have seen that exactly the opposite is the case. The precipitated condition is in a sense the unnatural state, the colloidal suspension being the normal state.

In many chemical reactions it is not necessary to add foreign ions in order to get a precipitate. This is because in most chemical reactions something is formed which is itself dissociated by the water, and, therefore, yields the ions necessary to form a precipitate from the otherwise colloidally suspended solid.

We can now understand the above reaction with arsenic chloride on the one hand, and arsenic oxide on the other, with hydrogen sulphide. When arsenic chloride is treated with hydrogen sulphide, arsenic sulphide and hydrochloric acid are formed. The latter is a strongly dissociated compound, and yields the ions necessary to cause the arsenic sulphide formed to precipitate.

When arsenic oxide is treated with hydrogen sulphide, arsenic sulphide and water are formed. Water is almost completely undissociated and there are, consequently, no ions present to cause a precipitation of the sulphide of arsenic. It remains in the "natural state" of a colloidal suspension.

Role of Ions in Chemistry

These facts suggest a number of lines of thought. Ions as we shall see, are absolutely necessary for chemical action; but, more than this, they are necessary for the formation of a precipitate after the solid is once produced in the presence of a liquid. Ions, are therefore, essential to all chemical analysis.

We were accustomed, until recently, to look upon a solid brought into the presence of a liquid and shaken as doing one of two things; either dissolving in the liquid forming a true solution in it, or as remaining in the presence of the liquid in a state of mechanical suspension. We had true solutions and mechanical mixtures. The former had quantitatively the three fundamental properties of true solutions. In the latter the properties of the solvent are not affected by the suspended solid particles.

We know to-day that we have a complete series of systems from the true solutions to mechanical mixtures, and every intermediate stage represented. We have true solutions, colloidal solutions, colloidal suspensions and finally mechanical mixtures, with a gradual gradation in properties from the one extreme to the other.

The last question that space will permit us to raise here in this connection is, whence the difference in the properties of these different systems? It should be frankly stated that we can not answer this question completely. This much is, however, certain. The state of division of the solid is finest in the true solution, is coarser in the colloidal solution, is still coarser in the colloidal suspension, and is coarsest of all in the mechanical mixture. It is impossible to say to-day whether this is the only difference in the solid particle. It is probably not. Other differences, however, may all be functions

of this difference in the size of the particle. It was hoped that space would allow something to be said in reference to colloidal suspensions of the metals. These are prepared by passing an electric discharge between two poles of the metal under water. These metallic suspensions are so coarse-grained that the particles can be seen under the ultramicroscope. These colloidal metals act catalytically like the organic enzymes, but for more of this see my "Elements of Physical Chemistry," fourth edition, p. 252.

Colloidal suspensions play a prominent part in physiology, and in living matter in general. Indeed, colloidal chemistry is just in its infancy, and we may confidently look for very important development in this field in the near future.

Solid Solutions

It is only recently that we have come to regard certain mixtures of solids as true solutions. Indeed, the term "solid solution" was seldom if ever used until it was made the title of a paper by Van't Hoff in vol. V, of the *Zeitschrift für physikalische Chemie*, in 1890. If used before that time it certainly had no scientific significance.

What justification have we to-day for referring to any mixtures of solids as "solid solutions?" Let us recall the three fundamental properties of true solutions. They are—osmotic pressure; lowering of freezing point, and lowering of vapor tension. Do the mixtures of solids in question have all or any of these properties? This was the question which Van't Hoff asked and answered, as we shall see, in the affirmative.

That solids dissolved in other solids lower each other's freezing points is shown by the alloys. Take Rose's or Wood's fusible metal. These alloys melt under boiling water; therefore, much lower than any of the constituents.

Is there any evidence of the lowering of vapor tension in mixtures of solids? The vapor tension of a solid is in general at ordinary temperatures very small; and therefore difficult to measure. Any change in this small quantity would also be difficult to measure. We must, therefore, look for some indirect method of solving this problem, and such was found by Van't Hoff.

Take the lead salt of dithionic acid. It decrepitates easily: i.e., if left to itself it readily flies to pieces. This shows that at ordinary temperatures it has considerable vapor tension.

Lead dithionate forms an isomorphous mixture with calcium dithionate. This means that a crystal of the lead salt has the same form as a crystal of the calcium salt, and will grow in a solution of the calcium salt or in a mixture of the lead and calcium salts, the crystal containing both salts. A crystal containing both of these salts decrepitates much less than a crystal of the pure lead salt, showing a diminution in the vapor tension of the lead salt by the presence of the calcium salt. The isomorphous mixtures are among the best examples known of solid solutions, and here we have the vapor tension of one of the solids lowered by the presence of the other.

Diffusion in Solids

Finally, have we any evidence of the existence of osmotic pressure in mixtures of solids? Again, we cannot hope to test this directly; but an indirect solution to this problem has been most satisfactorily furnished in the paper referred to above by Van't Hoff. Osmotic pressure is the cause of diffusion. If there is diffusion in mixtures of solids there must be osmotic pressure there to cause it—we have abundant examples of diffusion of solid through solid.

Place a porcelain crucible in a cavity cut in a piece of charcoal and heat the whole. The charcoal will penetrate clear through the walls of the porcelain crucible and can be found on the inner side.

Again, cover a zinc object electrolytically with a thin layer of copper and lay it aside at ordinary temperatures. The object will soon become white again, due to the diffusion of the zinc into and through the copper.

One of the best examples of the diffusion of metal through metal has been furnished by Roberts-Austen. He clamped discs of gold to the bases of lead cylinders and allowed these to stand in contact with one another, at ordinary temperatures, for several years. He then removed the gold disc, and cut slices of the lead cylinders and assayed them for gold. At the end of four years it was found that the gold had penetrated about 8 mm. into the lead. These results are all conclusive proof that we have diffusion of solid in solid at ordinary temperatures; therefore, conclusive proof of the existence of osmotic pressure in mixtures of solid in solid.

Solid Solution Not a Mere Name

Certain mixtures of solids then, have all three of the fundamental properties of true solutions in liquids as solvents, and are, therefore, just as much entitled to be called solutions as the latter.

A fairly large amount of work has been done, especially by the Italians, on the kinds of substances that can form solid solutions with one another, and some relations of interest and importance have been brought out. Thus, in the aromatic or benzene compounds only those substances can form solid solutions with one another which have the same number of "benzene rings" in their molecular structure.

Further, the properties of solid solutions have been utilized to determine the molecular weights of a few substances in the solid state. We have no reliable method even to-day for determining the molecular weight, or the number of the simplest chemical molecules aggregated to form the physical molecule of even the simplest chemical compound in the solid condition. We do not know the chemical formula of ice. We have seen that the chemical formula of water, at ordinary temperatures, is $(H_2O)_4$. We have no idea what the state of association of water is when it passes over into the solid state, and no well founded method even of attacking this problem. We do not know the formula of solid sodium chloride or rock salt.

The study of solid solutions has thrown some little light on such problems, but for this, reference must be made again to my "Elements of Physical Chemistry," fourth edition, pp. 310 to 317.

Undissociated Substances Do Not React Chemically

It would not be satisfactory to leave the subject of solutions as such, without saying something on this important bearing of the theory of electrolytic dissociation. According to the theory of electrolytic dissociation, it is the ions or charged parts that are the active agents chemically. Molecules as such can not act chemically. Ions or charged parts may react with molecules, but two uncharged parts cannot enter into chemical reaction.

This conclusion from the theory of electrolytic dissociation is one that can be tested easily and convincingly. The way to test whether ions are the active chemical agents is to increase the number of ions present and see whether chemical activity increases. This has, of course, been done, and with the general result that chemical activity was found to increase and proportionally to the number of ions taking part in the reaction.

The sequel to this is the point upon which it is desired here to lay stress. To see whether molecules can react chemically it is only necessary to exclude all ions, and then observe the result. Special precaution must be taken to exclude ions. This will be seen to be the case, when it is pointed out that not only water but many other, indeed most liquids, possess some ionizing power. Again, temperature can produce ions, fused salts showing marked conductivity. However, ions can for the most part be excluded as follows. Dry the substances thoroughly over phosphorus pentoxide and then study the chemical behavior of the substances thus dried.

Wanklyn has shown that dry chlorine gas does not act upon dry metallic sodium, although moist chlorine reacts

readily, especially at elevated temperatures.

Peculiarities of Dry Hydrochloric Acid

Baker has shown that perfectly dry phosphorus does not burn in carefully dried oxygen; but what is, perhaps more remarkable, dry hydrochloric-acid gas does not react with carbonates. Indeed, liquid hydrochloric acid made from the carefully dried gas has no trace of acid properties. It will not act on dry metals, will not decompose carbonates and will not even color blue litmus red. Dry hydrochloric acid gas dissolved in a non-dissociating solvent such as dry chloroform or dry benzene will not color blue litmus red.

Perhaps a more remarkable case is the lack of action between dry hydrochloric-acid gas and dry ammonia gas. Baker in England has shown that when the proper precaution is taken to dry both of these gases, there is not a trace of chemical action between them when they are brought together.

Most remarkable of all, however, is an experiment which I saw performed on the lecture table of the Chemical Society of London. Metallic sodium, which had been dried with special care, was plunged into sulphuric acid which had been dried with equal care. The sodium remained suspended in the sulphuric acid as quiescently as if it were immersed in ligroïn. These examples suffice to show the chemical inactivity of molecules.

Energy Changes in Chemical Reactions

The statement has often been made that chemical reactions are accompanied by thermal changes. It means to state that whenever a chemical reaction takes place there is heat either evolved or absorbed. If it is used to imply that the chemical reaction is the important thing and the energy change of subordinate importance, the statement would, as we shall see, be as far from the truth as it is possible to go.

Whenever a chemical reaction takes place we always have heat either evolved or absorbed, and usually evolved. We may have electrical energy produced, and if the reaction proceeds with sufficient rapidity we may have light. The question arises whence come these various forms of energy? From the law of the conservation of energy we know that energy can come only from energy. There must, therefore, be some form of energy in the atoms or molecules which, in chemical reactions, is converted in part into other forms.

The amount of heat energy that is produced when some chemical reactions take place is very great indeed. The most exothermic of all chemical reactions is the union of hydrogen with oxygen. The amount of heat that is liberated in the burning of coal is also large, and there are many other chemical reactions with large exothermal values.

The question is in what form is the energy in the atoms that in chemical reaction is converted into other forms? It was called intrinsic energy to distinguish it from extrinsic forms of energy. It was something inherent in the atom itself, and thus differed from heat, light, electricity, etc., which were extrinsic to the atom, and into which intrinsic energy could be, to a greater or less degree, converted.

This was, of course, nothing but a name, and explained nothing. To call the energy within the atom intrinsic, simply differentiated it from external manifestations of energy, but gave no physical conception of the nature of intrinsic energy. I remember well when I first began to teach physical chemistry 18 years ago, that it was impossible to give any adequate or satisfactory interpretation of what was meant by intrinsic energy. What was its nature, what was it doing within the atom? These were questions that naturally arose but could not be answered. Intrinsic energy was even then simply a term for something which we knew to exist, but about the nature of which we knew absolutely nothing.

Electron Theory of Thomson

This is all changed now, thanks to the electron theory. Sir J. J. Thomson, as is well known, has shown that all of the atoms of all elementary substances are complex, and are probably made up of the same constituent—electrical charges. These charges, called electrons, are moving with high velocities within the atoms. These electrical charges have been shown to have mass. Indeed, all of the mass of the atoms is probably due to the electrons; these being the ultimate units of which all matter is made up. Indeed, the term matter is a pure product of the imagination, having no counterpart in fact, cannot be detected even qualitatively by any method known to man, and was created simply to have something on which to hang energy. We could not think of energy in the abstract, and therefore imagined the existence of another entity than energy and called it matter.

The fundamental properties of what we called matter are mass and inertia; but it has been shown that all of the mass and all of the inertia of what we have called matter are probably due to the electrical charges that make up the atom. Consequently, there is no longer any occasion for assuming the existence of any entity other than energy—no occasion for assuming the existence of matter, because there are no properties which are not possessed by the energy alone, and the conception matter will doubtless be gradually abandoned.

Space will not here permit of a scientific discussion of this question. Those who may be interested in it, will find it treated in a fairly elementary manner in my book, "The Electrical Nature of Matter and Radioactivity," second edition, published by the D. Van Nostrand Co., New York.

Properties of the Electrons

The point here is that the electrons, or isolated electrical charges, have mass and are moving with high velocities. Having mass and velocity the electrons have kinetic energy; and although their mass is small, their high velocity gives them a large amount of kinetic energy. (Kinetic energy $= \frac{1}{2} mv^2$, m being the mass and v the velocity of the moving particle.)

We can then think of the intrinsic energy of the atom as being essentially the kinetic energy of the moving electrons which compose the atom, and can thus form a physical conception of what is meant by intrinsic energy.

Why Do Chemical Reactions Take Place?

We now come to the fundamental chemical question, why do chemical reactions take place? Why is it that some substances react chemically and others do not? No satisfactory answer to this question could be given until the energy changes that take place in chemical reactions were studied.

It was the French chemist, Berthelot, who, about the middle of the last century, began to study the heat changes that manifest themselves whenever chemical reaction takes place. He opened up the whole subject of thermochemistry, and from that time to the present more and more thought has been devoted to the energy changes that occur in chemical reactions. This is the natural order of events. The material changes were studied first, partly because they were the most obvious and partly because men desired the products of the reaction for one purpose or another.

One result of the study of these energy changes, is that we have now a pretty clear conception of why a chemical reaction takes place. When the two substances which are brought together differ largely with respect to the amount and potential or intensity of the intrinsic energy that they contain, they become unstable when in the presence of one another. Some of the intrinsic energy in one or both passes over into heat or other forms of energy, and the substances combine and form a system more stable under the new conditions. This is a chemical reaction, and the cause is to be found in the differences

in the intrinsic energy present in the substances which react.

The old statement that "a chemical reaction is accompanied by a thermal change" is, therefore, just as reasonable as to say that a cart is accompanied by a horse. It interchanges completely cause and effect.

Transformation of Intrinsic Energy into Other Forms

One of the greatest if not the greatest problem for the engineer is the discovery of an economical method for transforming intrinsic energy into electrical energy and light. A glance at the methods now in use for effecting these transformations will make this clear.

The primary cell was, for a long time, the best means of converting intrinsic energy into electrical energy. The materials that gave the best results in the primary cell were, however, so expensive, that this means of obtaining electrical energy was never satisfactory, and was never feasible for general use in the industries.

The primary cell was practically supplanted by the dynamo and the secondary cell, and the great advances that have been made in the application of electricity to the industries we owe primarily to them. But this method of transforming intrinsic energy into electrical, still leaves much to be desired. The dynamo is usually driven by a steam engine, and the best steam engine is a horrible waster of intrinsic energy. When coal is burned in the furnace of a steam engine a part of its intrinsic energy is converted into heat. The amount of available intrinsic energy in carbon is the difference between the total intrinsic energy of carbon and the intrinsic energy of carbon dioxide—its highest oxidation product. Every chemical compound contains some intrinsic energy; therefore, in no case can all of the intrinsic energy present in the elements be converted into other forms of energy—in no case is all of the intrinsic energy of the elements available.

Wasteful Energy Transformations

Of the heat energy produced in the furnace of the steam engine from the intrinsic energy of carbon, about 90% is lost. It is a good ordinary steam engine that has an "efficiency" of 8%, and an exceptional one with an efficiency of 10%. This means that only one-tenth of the heat produced in the furnace from the intrinsic energy of the carbon and of the oxygen is transformed in such an engine into work, and can be expended in driving a dynamo. Nine-tenths of the heat energy obtained in this chemical reaction from the intrinsic energy of the substances reacting is thus lost, at once, in the early stages of the transformation of intrinsic energy into electricity and light. Of the 6, 8 or at most, 10% of heat transformable into work in the steam engine, not much is lost in driving the dynamo and producing electrical energy; so that we may say that approximately one-fifteenth of the heat obtained in the furnace of the steam engine from the intrinsic energy of the substances taking part in the chemical reactions in the furnace, is transformed into electrical energy.

Think of the magnitude of this loss. It is simply distressing. But when we attempt to transform the electrical energy in question into light the figures are still more startling. If we use the ordinary carbon filament only about 2 or 2½% of the electricity is converted into light. This shows that of the total intrinsic energy of the coal converted into heat in the furnace of the steam engine used to drive the dynamo to produce the electricity which we convert in small part into light, only a fraction of 1% (0.25) is converted into light and the remainder is lost as heat. If we use some of the newer forms of filaments, such as the tungsten filament, we can increase the amount of light produced about twice. But even then we get only ½ of 1% of the available intrinsic energy of the coal that is burned as light.

Some of the arcs recently devised are less wasteful of electrical energy than even the tungsten filament, but in some of these, the question arises as to the effect on the human eye.

The importance of the problem in hand is obvious after a moment's reflection. He who devises a method for converting available intrinsic energy, even approximately quantitatively, into electricity, will be a benefactor to the human race. There are few problems whose solution would produce as great an effect upon the industries in general.

Intrinsic Energy into Heat

The reciprocal conversion of intrinsic energy into heat, and heat into intrinsic energy constitutes the subject matter of thermochemistry. That heat can be converted into intrinsic energy is demonstrated whenever we break a chemical compound down into its elements simply by raising the temperature. A part of the heat energy that disappears is converted into intrinsic energy, i.e., probably increases the velocities of the electrons within the atoms. The elements within the compounds have their intrinsic energies raised to a level where they are stable in the elementary state, and the compound breaks down into its elements.

If we wish to measure the difference between the amounts of intrinsic energy in the elements and the compound which they form, we measure the heat that is liberated when the compound is formed from the elements. This heat set free in the reaction is a measure of the intrinsic energy that has disappeared in the formation of the compound, provided that no light or electricity are produced, and no external work done as when a gas is formed. These factors must, of course, also be taken into account, since they owe their origin to the intrinsic energy that has disappeared.

Thermochemical measurements, then, enable us to determine the amount of intrinsic energy that has disappeared in any given chemical reaction, and it is the intrinsic energy that gives us the other forms that manifest themselves in chemical reactions. Such measurements are thus obviously fundamental for the engineer. If thermochemical data are desired the best can be found in Julius Thomsen's "Thermochemische Untersuchungen" and in Berthelot's "Etudes de Dynamique Chimique."

Rand Power Company

Johannesburg Correspondence

At the first annual meeting of the Rand Mines Power Supply Co., which is interested with the Victoria Falls & Transvaal Electrical Supply Co., it was stated that a profit of £32,000 was made despite minor troubles in starting up the large electrical generators and air compressors at Rocherville power station. They state that only one real difficulty which hampered operations occurred through "the failure of three large transformers, which our engineers inform us was entirely due to defective workmanship on the electrical windings." This is reassuring in view of rumors of other serious defects and the probable need of placing the transmission lines underground. They state "the plant generally has given an excellent account of itself, particularly the compressed-air scheme; the large rotary air compressors, which are the largest in the world, have been an unqualified success."

Allis-Chalmers Co.

Receivers were appointed, on Apr. 6, for Allis-Chalmers Co., the receivers being D. W. Call, president of the company, and Gen. Otto H. Falk, president of the Merchants' & Manufacturers' Association, of Milwaukee. While no statement to that effect could be obtained, the proceeding is probably intended to facilitate the early reorganization of the company, details of which have lately been published. The works will be operated by the receivers with no cessation of activity in any line. Irving H. Reynolds, chief engineer of the company, during a more profitable period of its operations, is the last of a number of men recently announced as returning to the company.

New Publications

THE NEW MADRID EARTHQUAKE. By Myron L. Fuller. Pp. 119, illus. Bull. 494, U. S. Geological Survey, Washington, D. C.

MECHANICAL STRESSES IN TRANSMISSION LINES. By A. Guell. Pp. 31, illus. Bull. No. 54, University of Illinois, Urbana, Ill.

WATER POWERS OF NORTH CAROLINA. Pp. 383, illus. Bull. No. 20, North Carolina Geological and Economic Survey, Raleigh.

WATER POWERS OF CANADA. By Leo G. Denis and Arthur V. White. 7x10, pp. 397, illus. Commission of Conservation, Ottawa, Canada.

MINING LAWS OF THE STATE OF MONTANA. Compiled from the Revised Codes of 1907 and Session Laws of 1909-1911. Pp. 106. State Inspector of Mines, Helena, Mont.

A GEOLOGIC RECONNAISSANCE OF THE ILIAMNA REGION, ALASKA. By G. C. Martin and F. J. Katz. Pp. 137, illus. Bull. No. 485, U. S. Geological Survey, Washington, D C.

RESULTS OF TRIANGULATION AND PRIMARY TRAVERSE FOR THE YEARS 1909 AND 1910. By R. B. Marshall. Pp. 392. Bull. 496, U. S. Geological Survey, Washington, D. C.

MINERAL RESOURCES OF THE UNITED STATES, 1910. PART I, METALS; PART II, NONMETALS. Pp. 796 and 1005, respectively. U. S. Geological Survey, Washington, D. C.

GEOLOGY AND COAL FIELDS OF THE LOWER MATANUSKA VALLEY, ALASKA. By G. C. Martin and F. J. Katz. Pp. 98, illus. Bull. No. 500, U. S. Geological Survey, Washington, D. C.

ANNUAL REPORT OF THE WEST VIRGINIA DEPARTMENT OF MINES FOR THE YEAR ENDING JUNE 30, 1910. Pp. 333, illus. John Laing, Chief of Department of Mines, Charleston, W. Va.

A RECONNAISANCE OF THE JARBIDGE, CONTACT, AND ELK MOUNTAIN MINING DISTRICTS, ELKO COUNTY, NEVADA. By F. C. Schrader. Pp. 170, illus. Bull. 497, U. S. Geological Survey, Washington, D. C.

THE MINING INDUSTRY IN NORTH CAROLINA DURING 1908, 1909 AND 1910. By Joseph Hyde Pratt and H. M. Berry. Pp. 134, illus. Economic Paper No. 23, North Carolina Geological and Economic Survey, Raleigh.

THE PHYSIOGRAPHY AND GEOLOGY OF THE COASTAL PLAIN PROVINCE OF VIRGINIA. By William B. Clark and Benjamin L. Miller. Pp. 274, illus. Bull. No. 4, Virginia Geological Survey, Charlottesville, Va. Includes Chapters on "The Lower Cretaceous," by Edward W. Berry, and "The Economic Geology," by Thomas Leonard Watson.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE WESTERN STATES AND TERRITORIES IN 1910. Mine Production, Advance Chapter from Mineral Resources of the U. S., 1910. By A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey and C. G. Yale. Pp. 308. U. S. Geological Survey, Washington, D. C.

ANWENDUNG PHYSIKALISCH CHEMISCHER THEORIEN AUF TECHNISCHE PROZESSE UND FABRIKATIONSMETHODEN. By Robert Kremann. Pp. 308, illus.; 9.60 marks. Wilhelm Knapp, Halle a. S., Germany.

The aim of this work, as the title implies, is to discuss the physical-chemical theories which underlie technical processes.

The more important matters discussed are: The two laws of the mechanical theory of heat; catalyzers and reaction velocity; special applications of the law of mass action, and the phase rule, in its various bearings on technical problems. The subjects incorporated in this book seem to be well discussed, and it will doubtless prove to be valuable to the engineer.

It does, however, seem to me to be unfortunate that the scope of the book is not more extended. Take, especially, electrochemical processes. These have come into the greatest prominence within the last few years. The principles which underlie these processes could have been treated more fully, and to advantage in this work. Again, the nature and significance of solutions for the industries, as well as for pure science, should, in my opinion, have been given more prominence.

These are, after all, only individual opinions, and we must usually respect that of the author, who has generally devoted far more thought to the subject than the reviewer.

H. C. Jones.

RECHERCHES PRATIQUE EXPLOITATION DES MINES D'OR (Practical Investigation and Development of Gold Mines). By Georges Proust. Pp. 110, paper; 2.75 francs. Gauthier-Villars, Paris.

This little manual is a popular outline of the more important features involved in prospecting and mining for gold. It begins with a sketch of the minerals constituting the rocks, so that the rocks themselves may be next described. Special stress is, of course, laid on those characteristically associated with gold. A brief summary of ore deposits follows. They are classified as regular and irregular in shape, and as primary and secondary in origin. Faults, veins and dikes receive a few pages.

The introduction being finished, gold itself is specially treated. The following topics are taken up: Ores, associates, shoots, veins and approved methods of attacking an orebody. Churn, calyx and diamond drills are described. Assaying, cupellation and crucible assays are explained to the novice. Operation is at last reached, the manner of the same being dependent, as M. Proust acutely remarks, upon the capitalist. The way in which the miner drills, blasts and blocks out his workings; the way in which the mill man treats his gold quartz with his "tables Wiffley," "his concentrateur Gilpin" and other familiar machines, will be interesting reading to those who long to win the yellow metal. An old friend, the cyanide process, masquerades as "le procédé Mac Arthur Forrest." At last, when the placers are reached, another old friend, "Le Long Tom," finds a paragraph beside the batea and the pan. In this portion even M. Proust cannot write without English—"sluices," "d i t c h e s," "flumes" and "bedrocks" are dotted throughout the French. A glossary of mining and mineralogical terms concludes the book. The subject of gold mining and milling is a large one to cover in 94 small pages. The treatment inevitably seems sketchy and fragmentary, but M. Proust has perhaps performed his difficult task as well as the conditions permitted.

AUTOBIOGRAPHY OF JOHN FRITZ. Pp. 327, illus.; $2. John Wiley & Sons, New York.

In commenting upon this book, noteworthy as the life-record of a most distinguished engineer and metallurgist, it seems to us best to begin with the words of its author, who says:

> In this short preface I wish to tell my friends who read this book how it was that I came to write it. My undertaking it came about wholly through the persistent urging of a number of old friends, who insisted on my writing out for them, in my own words, an account of my life struggles; and the publication of my autobiography before my death is again owing to the fact that, against my wishes, these good friends would not wait for it, but insisted on having it now. And so I have jotted down the record of my life, and it is given to you as I wrote it. You must not expect fine language nor eloquent periods, but only the honest record of the hard-working life of one who loves his country and his fellow men, and who has tried to serve both.

We are glad and the entire engineering profession will be glad that John Fritz's friends persuaded him to write this record of his life and work. He did not need to make any apology for literary deficiencies, because no criticism could possibly be offered on that ground, any more than upon Gen. Grant's plain unvarnished memoirs. The simple stories of their work by men who have really done things that are worth while are so rare that they are to be welcomed whether they come in purple and fine linen or just in greasy overalls. In truth John Fritz tells his story, particularly that of his boyhood days and the period of young manhood, in a way that may make the authors of some of the "best sellers" envious.

This is, of course, largely because he had a real story to tell, the story of a young boy brought up on the farm with but imperfect means of obtaining education, inheriting a mechanical instinct, learning how to do things by experience, growing up with the newly developing iron industry of Pennsylvania, and making himself an engineer of world-wide fame. John Fritz's story, especially up to the time when he left Cambria, crowned with success, in 1860, reads like a romance, and we think that anyone who once takes it up and falls under its fascination, must go on with it without interruption to the end.

We shall not undertake to moralize or preach from the story of John Fritz's life. We shall content ourselves with suggesting that all of our educators, who are directing modern engineering schools, ought to require their students to read this autobiography as a part of their course of instruction.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

J. Parke Channing has gone to Arizona.

Dr. James Douglas has gone to Arizona on a periodic trip of inspection.

Alexander Leggat, recently at Butte, Mont., has gone to Ulysses, Idaho.

H. R. Plate announces that after Apr. 28, his office as mining engineer will be at 14 Wall Street, New York.

A. W. Burgeon has returned from Mexico and is now at Placerville, Calif., at the Pacific and Poverty Point mines.

G. R. Empson has been chosen president of the Iron River Ore Co., Iron River, Mich., succeeding R. L. Hammond.

John Hays Hammond is to be at the head of a commission to go to Europe on behalf of the Panama-Pacific Exposition.

Emil Deister, formerly of the Deister Concentrator Co., is conducting tests of his slime-treating machine at the Miami mill.

Robert Linton, general manager of the Sierra Consolidated Mines Co., Ocampo, Chihuahua, Mexico, is at present at Los Angeles.

Prof. Robert H. Richards is in Denver, Colo., for a week's professional work. He will visit Rolla, Mo., and Hancock, Mich., on his return trip.

Marshall Haney, of Geer, Va., has been engaged for several weeks in examining manganese property in Virginia, and several large properties have been purchased on the strength of his reports.

Eugene F. Bradt, formerly chief engineer of the Pittsburgh & Lake Angeline Iron Co., has been at work recently on a newly opened property on the Vermilion Range, known as the Fargo mine.

Walter Harvey Weed announces that the firm of Weed & Probert having been dissolved, hereafter he will continue in practice as consulting engineer and mining geologist, with office at 42 Broadway, New York.

G. M. Richards has been appointed chief mining engineer for the Cie. des Chemins de Fer du Congo Supérieur aux Grands Lacs Africains. He left London, Mar. 25, for his headquarters, at Kasindi, Belgian Congo.

George Watkin Evans has resigned his position as chief of coal surveys for the Washington Geological Survey, and has opened an office in the Leary Building, Seattle, Wash., as consulting mining engineer and geologist.

J. T. B. Bogardus, president of the Abendroth & Root Manufacturing Co., builder of Root water-tube boilers and spiral-riveted pipe, has returned from an extended trip abroad in the interest of the export business of his company.

Manager F. P. Mills, of the Giroux Consolidated, in company with Mine Superintendent James Willoughby and Engineers A. J. Sale and Neil A. McGill, have been at Bingham, Utah, where they spent a week in studying the system of ore extraction in that camp.

Warren J. McLaughlin, Iron Mountain, Mich., until recently mining engineer at the Loretto mine, Menominee Range, which position he resigned to accept a similar post with M. A. Hanna & Co., Cleveland, has gone to the Trenton district of Ontario, to take up his new duties.

Wilbur E. Sanders is visiting R. C. Knox, superintendent of the Black Oak mine in Tuolumne County, Calif. Mr. Sanders is an authority on mine timbering; he is of the class of '88 Columbia School of Mines. He was for some time at Helena, Mont., and is now a resident of Pasadena, Calif.

O. R. Hamilton has resigned as engineer of the Spring Valley Iron Co., taking effect May 1. He will open an engineering office in Iron River, Mich. Mr. Hamilton will have associated with him E. L. Laing, who has been retained by the Davidson mine. The new firm will be known as Laing & Hamilton. Both of the engineers are graduates of the Michigan College of Mines.

Benjamin Guggenheim, president of the International Steam Pump Co., and formerly prominent in the management of the American Smelting & Refining Co., was a passenger on the lost "Titanic." At this writing it is uncertain whether he was saved or lost. Ernest Sjostedt, of Sault Ste. Marie, the well known metallurgist, was also a passenger, and the same uncertainty exists in his case.

The Council of the Iron & Steel Institute has this year decided to award the Andrew Carnegie gold medal to Dr. Paul Goerens, of Aachen, Germany. Dr. Goerens is a metallurgist, and is a member of the staff of the Royal Technical College at that city. He has made many contributions to scientific metallurgy, and in 1910 he was awarded one of the Carnegie scholarships of the Iron & Steel Institute to enable him to pursue his investigations on the influence of cold-working on the properties of iron and steel. The gold medal is now awarded to him in recognition of the highly meritorious character of his research work on this subject, which was published last year in Vol. III of the "Carnegie Scholarship Memoirs" of the institute.

Societies and Technical Schools

University of Idaho—Rush J. White, superintendent of the Federal Mining & Smelting Co., of Wallace, Idaho, addressed the Associated Miners, April 3. His talk was on milling practice and experiments carried on in some of his company's mills. The talk was representative of the character of progress along experimental lines in ore dressing in the Cœur d'Alenes.

University of Washington—The College of Mines of the University made its spring excursion for the mine inspection to Texada Island, B. C., from March 28 to April 6. The party consisted of 20 senior and junior students accompanied by Dean Milnor Roberts and Prof. Joseph Daniels. The objects of the trip were to study the deposits of iron, copper, gold and limestone, and to inspect the lime kilns, oil-burning smelter and mining equipment of the region. Headquarters camp was established at Van Anda, near the north end of the island.

American Peat Society—On April 9 four addresses—(1) "Fuel Conservation," by Dr. Joseph A. Holmes; (2) "Agricultural Possibilities of Muck Lands," by Prof. Geo. W. Cavanaugh, Ithaca, N. Y.; (3) "Peat Fuel is a Success in Europe. Why not in America?" Prof. Charles A. Davis, Peat Expert of Bureau of Mines; (4) Address by Prof. W. R. Beattie, of the Bureau of Plant Industry, Department of Agriculture—were delivered at the Chemists' Club, New York under the auspices of the New York Section, American Peat Society.

Columbia University, New York—The work of the summer school in assaying, formerly done in the Department of Chemistry, during the past year has been transferred to the Department of Metallurgy and is now a branch of that department. In giving this summer instruction in assaying it is intended to benefit young assayers who may happen to be in the vicinity and who desire to learn more about assaying from a theoretical standpoint. The future success of this course depends upon getting a sufficient number of outside men to attend it during the summer. The course lasts six weeks and is given under the direct supervision of Prof E. J. Hall, who has had charge of the Assay Department at Columbia for a number of years.

American Iron & Steel Institute—The second general meeting of the Institute will be held in New York, May 17 and 18. On Friday there will be three sessions, all at the Waldorf-Astoria hotel. In the forenoon, in addition to the address of the president, there will be papers and discussions on business topics. In the afternoon, the papers and discussions will be on scientific topics. In the evening the addresses will largely relate to welfare work in the iron and steel industry. In addition, there will be two addresses illustrated by moving pictures: one on "The Making of Big Guns at Bethlehem," and the other on "The Washing of Ores at Coleraine, Minnesota." Saturday is to be devoted to seeing New York, excursions of different kinds being planned.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 11—A plan has been submitted to the farmers providing for the complete resumption of copper smelting in Shasta County. The plan contemplates the payment of damages resulting from sulphur fumes, in such amounts as may be determined by a commission to be named by the parties interested. Naturally the management of the smelteries expects to solve the smoke problem and thus be exempt from the payment of damages. It is questionable if this result would be satisfactory to the farmers. In Calaveras County the Penn Mining Co. has practically completed the demonstration of the thiogen process, in operation at the smeltery at Campo Seco; there are some details of mechanical construction to be perfected which are not difficult. A committee of farmers and representatives of the boards of supervisors of the affected counties have expressed themselves as fairly satisfied with the demonstration recently made.

There is no present evidence of damage to vegetation from sulphur fumes in the vicinity of the smeltery, and it is doubtful if there has ever been any serious damage to the crops. This smeltery has been in operation for about 14 years, and there was no complaint from the farmers until the agitation in Shasta County had succeeded in closing three of the smelteries there. Recently complaints have been made that the fish in the Mokelumne River were being destroyed by drainage from the copper mines. When that charge was disproved the farmers concluded that the fish are victims of the tailings from the stamp mills. There is no question, however, that there has been damage done to vegetation by sulphur fumes in some of the copper-smelting districts, and that the agitation of the farmers has induced the experiments that have demonstrated the possibility of successfully neutralizing the smoke. But it is the opinion of men prominent in copper mining and smelting in California that the permanent settlement of the differences between the smelters and the farmers can best be accomplished by submitting the entire matter to the United States Bureau of Mines for determination. Until the matter is permanently settled the smelters are likely to be harrassed by suits whenever the farmers are disposed to complain.

The barren hillside in Mono County over which the Hydro-Electric company had obtained a permit to build a 3800-ft. pipeline has been saved to the forest reserve and posterity through the efforts of Gifford Pinchot and the action of Congress. The Hydro-Electric Co. supplies power to mines at Aurora, Lucky Boy, Rawhide, Fairview and Wonder. Nevada is particularly interested in the success of the power company and dependent upon it for the profitable operation of many mines situated near the California line. Mono County, California, is also largely dependent on the transportation of water across the hill that is called a forest reserve, but which is about on a par with the forest reserve in Shasta County that was used as an excuse for closing the Bully Hill smeltery. California has an abundance of this class of forests, and their conservation is a burden on the mining industry.

Butte

Apr. 10—At the Pennsylvania mine of the Anaconda company, work has again been started on the south crosscut at the 1800-ft. level. This crosscut was discontinued some time ago and a diamond-drill hole was driven from the face in a southerly direction. Several veins were cut and the drill was pulled about a month ago and the hole allowed to drain. A flow of over 200 gal. of water per min. was recorded at first, and this had to be hoisted by the Pennsylvania pumps in addition to the regular amount from the mine. The new pumps installed some time ago in anticipation of this event, easily took care of the increased amount however, and the sources supplying the drill hole are gradually being drained and at present only about half of the original amount is being pumped. The crosscut is not following the diamond-drill hole but is being driven parallel to it at a distance of about 10 ft.; in this way the work progresses more rapidly, as the workings are comparatively dry, the hole draining most of the water in the vicinity. The miners are able to do more work with greater ease in the dryer workings, as the water in conjunction with the heat, necessarily encountered at that depth, causes a humidity that is difficult and weakening to work in.

The Amazon-Montana Development Co., of Duluth, Minn., which has been developing a property at Amazon, 30 miles east of Butte, has canceled its lease on the mine and has taken over the Florence silver-lead mine at Neihart, southeast of Great Falls. The company has been reorganized under the name of the Florence Mining & Milling Co., and work on the new property has been commenced.

Denver

Apr. 11—The Colorado Grubstake & Mining Co. was organized last year and a working fund raised by voluntary contributions, the purpose of which was to send prospectors into the hills to search for and stake mining claims. The president of the Chamber of Commerce, as trustee, was to have half, and the prospector half of the claims so acquired. During last season 48 claims were staked and recorded, about 30 of which were adjudged worthy of development. But now it appears that inability to obtain working capital for the exploitation of these claims, is likely to cause the failure of the project.

It would do far more for the mining industry of the state if the absurdly high royalties exacted from leasers were reduced and more mines thrown open to the "tributer." Twenty per cent. on net smeltery returns is not an unusual royalty demanded, and from that upward. It is a good mine that pays 20% clean profit, but the leaser has to pay that to the owner, and make his own profit in addition, the result being that about 10% of them make wages and about one in a hundred makes a good profit from an unusually rich strike; this serves to inspire the others and keeps the game going on a limited scale, whereas if claim and mine owners would advertise for leasers at 10 and 15% royalties, with a small footage paid for dead work, the former would have their properties developed free of expense to themselves, more discoveries would be made and a greater output of ore furnished to the mills and smelteries.

In addition to the steel orders already chronicled in the columns of the JOURNAL, the Minnequa (Pueblo) plant of the Colorado Fuel & Iron Co. now has a contract with the Rock Island railroad for $300,000 worth of steel for improvements.

An interesting demonstration of mine rescue and first-aid work was given recently by the students of the State School of Mines at Golden, under Prof. J. C. Roberts of the U. S. Bureau of Mines. Rescue car No. 2 was there in charge of Mr. Roberts. The School of Mines tunnel was filled with powder fumes in which the men worked.

Salt Lake City

Apr. 11—A brief survey of the operations of the Tintic mines during the first three months of the year, shows that the majority have kept up past records or have exceeded them. Several new discoveries were made either late in 1911, or in the first quarter of 1912, and known orebodies opened satisfactorily. The Chief Consolidated with 30 cars for the first quarter of 1911 and 146 cars in 1912, shows a gain of 116 cars. At this mine, the present productive orebody was opened in December after almost a year's work, and the profits for February were nearly four times as great as those for the whole of 1911. New silver-lead and copper orebodies were opened in the Iron Blossom, which shipped 553 cars, exceeding the corresponding output of 1911 by 149 cars. The Mammoth increased production from 12 to 110 cars, and the Victoria opened new ore on the 1200, shipping 44 cars, as compared to 10. The Gold Chain, producing chiefly from above the 700, shipped 144 cars, as against 79, and the Beck Tunnel increased from three to 38 cars. The Grand Central, occupied with shaft sinking, mined 124 cars, as against 109. In the May Day, gold ore of shipping grade was opened on the 400, and lead ore of the same quality on the 1000-ft. level, shipments amounting to 56 cars, as compared to 34. The Eagle & Blue Bell opened a new orebody on the 1300, and shipped 72 cars, as compared to 10, most of the ore coming from below the 1000-ft. level. The Yankee shipped 92 cars of dump ore, from which development expenses were paid. The Centennial-Eureka leads with its remarkable steady output of 300 tons per day.

There are rumors of a consolidation of the Uncle Sam and the Richmond-Anaconda mines, at Tintic. The Richmond-Anaconda is being worked through the Uncle Sam, and development in the latter property is trending toward the Richmond-Anaconda line.

On Apr. 9, about 360 men, employed in the Boston Consolidated underground mine of the Utah Copper Co., struck for an increase of 50c., and this section of the mine has been closed down, awaiting settlement. The increase asked for is more than the average Bingham wage, and the men will probably return to work at the old rate in a few days.

Deadwood

Apr. 12—E. W. Walter, the new superintendent of the Black Hills Smelting Co., has been making an examination of the mines of the district for the purpose of ascertaining the probable kind and quantity of ore supply that may be expected at the plant. He has stated that copper ore from the Jungle mine, in the Custer Peak district, can be utilized to advantage. This mine is three miles from the railroad, with a good wagon road and down-hill haul. From the railroad station it will be a 7-mile haul to the smeltery. He is still in doubt as to the best procurable pyrite supply, but a large quantity is expected to be secured from the Gilt Edge Maid mine, near Galena. This ore will require concentrating, and a plant for handling that class of ores has been erected adjoining the smeltery. A large portion of the dry-ore supply will come from the Richmond mine, half a mile from the smeltery, where there is a large quantity of $7 to $10 ore ready to be mined.

At the annual meeting of the Deadwood Lead & Zinc Co., held in Deadwood, the following directors were elected: Aaron Dunn, president; P. M. Bonniwell, vice-president; George S. Jackson, secretary and treasurer; O. N. Brown and C. S. Ruth. The reports of the officers detailed tests made during the year in a search for a treatment method. The ore carries a heavy percentage of iron pyrite, about 10% zinc, a similar amount of lead, $3 in gold and 10 oz. silver.

Commercial use of power generated in the Homestake company's hydro-electric plant on Spearfish River, commenced on Apr. 11, when the first motors were started in the Amicus mill, the largest stamp mill of the company. During the morning the first motor, driving 10 stamps, was started, and by evening three motors were operating. Others will be hooked up as fast as possible until all of the stamps are electrically driven. The motor installation includes a 25-hp. motor for each battery of 10 stamps.

Toronto

Apr. 12—The Departments of Mines and Colonization of Quebec will send out three exploring expeditions this season. Professor Bancroft, of McGill University, will be in charge of a party, which will leave early in June, to examine the geology and mineral resources of the Abitibi region, south of the Grand Trunk Pacific railroad. Another party under Professor Dulieux, of the Polytechnic School of Montreal, will study the iron ores of the Lake St. John district, the Eastern townships, and the St. Jerome, Ottawa and Gatineau River regions. A colonization expedition will also be sent to Abitibi in charge of J. H. Valiquet, Inspector of Mines, who will establish colonization centers and open roads.

Cobalt

Apr. 12—The construction of the Elk Lake branch of the Temiskaming & Northern Ontario Ry. has been started, and 150 men are at work clearing and grading the right-of-way. It is expected that this will be finished about Sept. 1, when the commission will lay the steel and do the final ballasting. Trains should be running over the line by Jan. 1, 1913. While the road will give an impetus to mining operations in the Gowganda and Elk Lake sections, it is doubtful if the latter district will be benefited to any great extent. Prospecting has been carried on for several years and several properties have been opened, but as yet not one has reached the producing stage. The road, however, will pass through good agricultural land and will help in its development. Gowganda will benefit considerably in the matter of freight charges, which has been one of the greatest factors in holding back the country.

Porcupine

Apr. 12—The low water in the Mattagami River and the consequent shortage of power at the Sandy Falls plant are causing considerable uneasiness among the users of electrical energy supplied by the Sandy Falls power company. The dam is giving a good deal of trouble and is leaking badly in places. This power plant is operated by the same men who control the Hollinger mine, and the Hollinger management has recently ordered a 25-drill, steam-driven compressor for use on the property. Power costs in Porcupine are high, the lowest probably being between $125 and $150 per hp. year, and cheap electrical power would be a great boon to the camp. The plant at Waweatin Falls is to be rushed as rapidly as posible but it will be some-time before it is in efficient working order.

Jena

Apr. 8—Mention was previously made in the JOURNAL of a gas well having been struck at Neuengamme, on territory of the free city of Hamburg, which at the time attracted thousands of visitors to view the burning gas. Capitalists having been chary in taking hold of such a source of power and light, the Hamburg government has at last stepped in and purchased from the owner the land on which the well is situated, for $18,000. It is intended to pipe the gas to the Hamburg gas works and there to use it in admixture with the illuminating gas. The natural gas has the following composition: Methane, 91.6%; hydrogen, 2.3%, heavy carbureted hydrogen; 0.8%; oxygen, 0.7%; carbon dioxide, 0.2% and 4.4% nitrogen.

The gold discoveries in the Eifel Mountains, to which attention was first directed early in 1911, have now been sufficiently explored to show that they will not pay to work. Professor Klockmann, of Aix-la-Chapelle, pronounces them secondary deposits containing 0.05 to 1.5 grams of gold per cubic meter, which is equivalent to from 2½ to 76c. per cu.yd. At the time these discoveries were first reported, the deposits were referred to as reefs, and as having been encountered 8 ft. below surface. Later on it appeared that the discoveries were made in sand dunes.

The Mining News

The Current History of Mining

Alaska

Lon De Van—This mine, near Ketchikan, will probably install a reduction plant this summer. Drifting on the vein is being pushed. George J. Lonstorf, of Milwaukee, Wis., is president of the company.

Alaska-Mexican—During February the mill crushed 18,606 tons of ore, yielding $54,527 gross and net $18,136. Operating expenses were $32,332; construction, $4058; development, 552 ft. The ore averaged $2.96 per ton.

Alaska United—During February, the Ready Bullion and 700-ft. Claim mills crushed 35,784 tons of ore, yielding $90,260 gross and net $36,414. Operating expenses were $48,436; construction, $5410; development, 852 ft. The ore averaged $2.63 per ton at the Ready Bullion mill and $2.47 at the 700-ft. Claim.

Fairbanks District

It is predicted that the placer cleanup of the Fairbanks district for the coming summer will total about $5,000,000. Encouraged by the richness and number of veins that are being found, the placer operators who have heretofore held aloof are now becoming enthusiastic "hard rock" men.

Hudsons Brothers—The new find on Esther Creek has widened to 4 ft., and some asays show more than $300 per ton.

Fredericks—The shaft is now approaching the 300-ft. level. The owners expect to install 10 stamps this summer.

Arizona

Gila County

Old Dominion—The March smeltery production was 2,412,000 lb. of copper, of which about 95% was derived from ores from the Old Dominion and United Globe properties, the rest coming from custom ores. The El Paso Foundry & Machine Co. will construct a separate flue and dust chamber for the company's converter plant. The capacity of the present concentrator will be increased 50% and the classification and metallurgy improved. Approximately 1200 are now on the payroll. With the higher price for copper, it is possible to mine ore of lower grade than formerly. The concreting of the Kingdon shaft has been completed for 305 ft. below the collar.

Southwestern Miami—This company is continuing its drilling operations, and reports its No. 2 and No. 3 holes as continuing in chalcocite-bearing schist. Hole No. 4 is 90 ft. deep in conglomerate. Hole No. 5, union hole, is 40 ft. deep in conglomerate. Hole No. 6 will be started soon, making four drills in operation, in addition to the one on the Barney group.

Barney—Churn-drill hole No. 2 is 480 ft. deep and is apparently getting out of the conglomerate into the schist formation, but the ground is still badly broken and drilling proceeds with difficulty. The sludge is heavily iron-stained.

South Live Oak—L. D. McClure, managing director, and H. E. Dunn, manager, are superintending work preparatory to exploring. About 15 men are employed in building a camp, constructing roads to drill-hole sites, putting in pipe lines, hauling supplies, etc. Five cars of machinery, tools and supplies are on the road, and it is expected that drilling will begin about May 1. It is proposed to drill the first hole near the south end of the property in the granite-porphyry formation, which is thought to be underlain with schist. The first payment on the property, of $12,500, will be made on Apr. 15. There are about $60,000 in the treasury with which to make the first payment on the property and to conduct churn-drilling operations during the coming year.

Manitou—The Cracker Jim shaft, at the Five Points mine, caved in last week, burying Henry Peryam, a miner, who was rescued alive and unhurt after four days and nights. The caving started near the bottom and worked upward; Peryam took refuge in a short crosscut near the bottom of the shaft and thus escaped death. Miners from the Old Dominion and Gibson mines assisted in the rescue, which was dangerous and difficult work on account of the constant caving of the ground, and the fact that the shaft timbering had to be supported by wire cables from the surface. The shaft has been abandoned and work at the property discontinued.

Miami—Experiments are being made with a roughing system in the sixth unit. Emil Deister, formerly of the Deister Concentrator Co., has erected one of his new six-decked, slime-treating machines below the first unit and is conducting tests.

Pima County

Ostrich—This property, in the Arivoca district, is under bond to men represented by M. J. O'Brien, of Toronto, Ont. Negotiations for the Yellow Jacket, adjoining, are under way. T. J. Woodworth, of Toronto, recently examined the properties for the Canadian interests.

Santa Cruz County

Elephant's Head—This mine has been sold to Topeka, Kan., men, for $60,000 cash, by Louis Tremaine and Benjamin Daniels, former marshal of the Territory of Arizona. The money has been paid over to the bank, and will be paid to the former owners as soon as the title can be perfected. There is a large amount of milling ore developed in this mine. It is the intention of the buyers to do considerable development.

Three Stars—This claim has been leased from the Security Mining Co., by T. F. Gardner, and a force of men is now at work in the shaft. The ore is high-grade silver-bearing gray copper, and will be shipped to the smeltery.

Bradford—This claim, near the railroad in Sonoita Cañon, has been leased by the Ferry Estate to E. McFarland, formerly of Courtland. Bisbee men are interested in the undertaking. The ore developed by diamond-drill runs 18% copper.

Yavapai County

United Verde—A contract will be let soon to construct a standard-gage railroad, six miles long, from the 1000-ft. tunnel to the site of the new smeltery. The road may be continued through the valley to afford a market for the farmers.

California

Amador County

Lincoln Consolidated—The lower level of the Lincoln is being unwatered preparatory to extending the drift into the Wildman-Mahoney.

Central Eureka—The 7-ft. vein reported to have been disclosed in the south end of the mine was found in a crosscut to the east from the south drift. This is on the 2700-ft. level.

Plymouth Consolidated—Much of the timbering in the Pacific shaft has been found in fairly good preservation at a depth of 500 feet.

Hardenberg—Development by vertical shaft is progressing, though it is somewhat retarded by the large volume of water.

Calaveras County

Boire—The gravel deposit in this mine, at Railroad Flat, has been developed for

a length of 160 ft., and to an average depth of 8 ft. The gravel is cemented and will require crushing. A 10-stamp mill is contemplated. Boire Brothers are owners.

Pacific Gas & Electric—The company has notified the mines using direct water power that there is likely to be less than normal supply of water unless used conservatively, and that it may be necessary to curtail the supply in June.

Penn—This company has installed the thiogen process for the neutralization of smeltery smoke at its copper mines, at Campo Seco. The boards of supervisors of Calaveras, Amador and San Joaquin Counties, and the farmers who have been complaining, sent representatives to witness the demonstration of the process, and expressed themselves as satisfied. Dr. Stewart W. Young, of Standford University, installed the process, and it is believed by him and others that it will successfully control the sulphur fumes. Donald Smith is metallurgist in charge.

Melones—A new electrical hoist will be installed on the 1100-ft. level. The old hoist is 25 hp. The new hoist is to be 250 hp., 450 r.p.m., driven by a 2200-volt General Electric motor. The capacity will be 1000 ft. per min. for hoisting loaded 70-cu.ft. skips. This hoisting station is about 5000 ft. in from the portal of the main tunnel. W. G. Devereux is manager and John Fulton is superintendent.

Kern County

King Solomon—Ernest Peden, a leaser at this mine, fell through the main shaft, Mar. 31, a distance of about 200 ft., and was instantly killed. There was some delay to the skip that was to carry the men to the surface, and Peden, with others, climbed the ladder.

Nevada County

Hurst-Travis—A 5-ft. quartz vein has been disclosed in this gravel mine at Graniteville. Samuel Hurst and A. Travis are the owners.

Placer County

Gavin—A 10-years' lease has been taken on this property, near Forest Hill, on the middle fork of American River, by Arthur W. Copps, of Oakland, who also has a 10-years' lease on the Cache Rock dredge and dredging land. The Gavin property will be worked by tunnel.

Sierra County

Mountain—This mine, which was once a large producer, is reported to have been acquired by Denver men.

Phoenix—Good ore has been encountered, at this Sierra City mine, during the winter's development work, and it is being crushed in the mill on the property. Hamilton & Wise are operating the property under bond.

Gibraltar Consolidated Gold Mining Co.—This company has been formed to obtain and operate the Gibraltar mine, near Downieville. The directors are Jacob Kieffer, Peter Kieffer, T. J. Donovan, P. L. Carmichael and Adam Kieffer.

Siskiyou County

Blue Ledge—There is a tentative agreement between Robert S. Towne, recent purchaser of this copper mine, and about 300 citizens of Medford, Ore., to construct a railroad from Medford across the state line to the Blue Ledge mine. It is reported that the citizens agree to subscribe $75,000 toward constructing the road.

Tuolumne County

Black Oak—The installation of the 75-ton, all-slimes cyanide plant, tube mill and 20-stamp mill has been completed, and was put in commission on Feb. 3. The plant is electrically driven. A Stromberg-Carlson minaphone will be installed on the 1500-ft. level. Other stations will also be connected by telephone. The stamps and tube-mill construction were installed by the Trent Engineering Co., of Reno. The installation of the cyanide plant was made by C. H. Urquhart. R. C. Knox, Tuolumne, is superintendent.

Colorado

Clear Creek and Gilpin Counties

Belleview Consolidated Mines & Power Co.—This company has been organized and will develop the Gold Dirt and Perigo mines, with the Pactolus and Rollinsville placers, the latter covering about 2500 acres. The lode mines have been worked since 1860 and are credited with a large production. Lately they have been worked entirely by leasers, and every pound of ore which could be obtained has been extracted. The new company will have to do a large amount of development to create ore reserves. The placers are to be tested by drilling this summer and if satisfactory a dredge will be installed. The president and manager of the company is Charles Knight and the directorate is composed of Denver men.

Cripple Creek District

Blue Flag—It is stated that the March output averaged $2.50 per ton and that the mill is to be enlarged to a capacity of 3500 tons per month, under the direction of John Masson, metallurgist.

Clara D.—Lessees Meldrum & Co. have opened 4 ft. of good-grade mill ore in this mine on Gold Hill.

Midget Bonanza—This mine on Gold Hill has been leased to Owen Roberts, of Cripple Creek, who is also operating the El Paso Gold King. The erection of a 100-ton mill to treat the dump ore is contemplated.

Portland—President Frank Peck and the directors have decided to lease 25 acres of virgin ground belonging to the company. This land is over the hill from the main workings of the company, and on the north slope of Battle Mountain.

American Eagles—The March output of this Strattons Estate property was about 17 cars, and the grade is stated to have been from $60 to $100 per ton.

Lake County—Leadville

A good deal of development work is being done in the Mosquito Range, Birdseye and other outlying sections of the Leadville district. The Mosquito group of 14 claims is to be worked from the Park County side through the Mazie tunnel; the Killarney group on Corinne Mountain, owned by Leadville men, is being developed by a tunnel already in 150 ft., which will be driven to the London fault at a point 400 ft. below the surface; on the Birdseye side, the Anderson Consolidated tunnel has been driven all winter, and is now in 500 ft.; a mile north of the head of Birdseye, the Jupiter group of 14 claims is being developed by a tunnel which is already in 100 ft. The Yak tunnel breast is now in Vega territory and is close to the base of the Mosquito Range.

Resurrection No. 1—The work, which was stopped by the heavy snows, has been started again and with the better roads shipping has been resumed.

Lillian—Regular shipments of carbonate of zinc ore are being made from the Murcrary lease on this mine. The grade is holding well and development is being kept ahead of extraction.

Denver City—An electric hoist has been installed at this mine on Yankee Hill. As soon as the old workings have been cleaned out, exploration for zinc ore will be started.

Idaho

Hydraulic mines in Boise County will be worked this season by the following operators: Boise Basin Hydraulic & Power Co., Leary & Brogan Placer Co., and Thomas Hally, at Placerville; Hardwood Glenn Mining Co. and the Centerville Mining & Milling Co., on Grimes Creek; the White Quartz Mining Co., at Idaho City.

Idaho County

Colonel Sellers—An unusually rich strike was made recently on this claim in the Elk City district, owned by Mrs. M. A. Parr, of Elk City. The oreshoot has so far been uncovered for 300 ft. The width varies from 3 to 14 ft. Seventy-four tons, run through the 3-stamp mill, yielded 800 oz. of amalgam, worth $4.50 per oz. The concentrates ran $581.60 per ton and tailings $16.35. The property lies about one mile north of the Buster mine, and about two miles from Elk City.

Michigan

COPPER

Mass—A special stockholders' meeting will be held May 8 to vote on a proposition to sell a portion of the company's lands to a new company to be formed to develop the lands. The stockholders will be given the privilege of subscribing for the stock in the new company. This plan will replenish the treasury and give a working capital to conduct mining on a more extensive scale; also to make repairs at the mine and mill, and to develop the lands which it is believed carry the extensions of the Lake and Arcadian lodes.

Arcadian—At a depth of about 1085 ft. in No. 23 drill hole, which is sinking in the vicinity of Ripley, near Portage Lake, copper was encountered; the core showed the formation to be well mineralized and carried considerable heavy copper. This is the second formation that has been penetrated by this hole, the first having been reached at a depth of about 330 ft. and showing a formation about 25 ft. wide with copper.

Oneco—The shaft is nearing a depth of 1220 ft. from which depth the rich drill core was extracted some months ago; the shaft is expected to reach this depth about May 1. After this attention will be given to lateral openings and the lode will be fully explored.

Osceola Consolidated—The taking of depositions in the injunction proceedings restraining this company from holding its annual meeting, brought about by Charles M. Turner, was called on Apr. 10 at Houghton. W. J. Uren, formerly general mine superintendent of the Bigelow properties, and upon whose affidavits the injunction is sought, was called but refused to take the stand. His attorneys stated that he was willing to file further affidavits elaborating on anything further desired and that he would take the stand at the trial which is called for Apr. 16, at Lansing, before Judge Weist, but that he did not desire any preliminary hearing before a notary. The hearing was then discontinued.

Cliff—The report of this Calumet & Hecla subsidiary for 1911 shows: Exploration and development, $13,867; surface and construction work, $908; miscellaneous, $1228; total, $16,004; balance of assets, $75,756. The vertical exploratory shaft was 217 ft. deep at the end of the year. Drifts north and south at 205 ft. failed to disclose copper-bearing lodes. A crosscut is being driven from the north drift to cut the west lode.

Mohawk—During 1911, receipts from 12,091,056 lb. of copper sold at 12.63c. per lb. were $1,527,107. Expenses at the mine were $1,128,333; smelting and other expenses, $97,988; construction, $31,279; net profit, $269,506; surplus Dec. 31, $590,880, an increase of $94,506 over the previous year. Operations at the mine were satisfactory and the grade of the rock improved.

Indiana—Reports state that heavy copper in felsite has been encountered 28 ft. from the shaft in a crosscut at the 600-ft. level.

Naumkeag Copper Co—The following constitute the first board of directors: J. Parke Channing, J. H. Sussman, Adolph Lewisohn, Theodore L. Herman, Frank L. Van Orden, Charles J. Paine, Jr., and Irving J. Sturgis. The officers are: Mr. Channing, president; Samuel A. Lewisohn, vice-president; Mr. Sussman, secretary and treasurer. Mr. Van Orden will be in charge at the property.

IRON

American—It is reported that a concentrator will be erected this summer to treat the low-grade ore on this property, about 10 miles east of Ishpeming.

Mary Charlotte—The working force was reduced recently by suspending one of the three daily shifts. About 100 men are said to have been released. This action was caused by the prevailing low price for iron ore.

Minnesota

The shipping season from the Mesabi Range is said to have started a few days ago, when the Great Northern Ry. hauled ore to its Allouez docks.

Koochiching-Vermilion—Gold-bearing rock is reported to have been cut by this company in diamond drilling near Northome, a town on the Minnesota & International Ry., in the southwestern part of Koochiching County and about 75 miles northwest of Hibbing. Such discoveries have been made before, but no commercial operations have resulted.

Missouri

NEWTON COUNTY

Wentworth Land & Mining Co.—This company, owner of the Alice Dayton mine, has taken an option to purchase the fee of 160 acres of land near Wentworth, known as the old Gobbler tract. This tract was once one of the large producers of the district and large bodies of ore found by drilling at that time, have never been developed. The company intends to develop these deposits thoroughly and pumping machinery is now being installed to drain the ground.

Mocking Bird—The company recently installed a crusher and rolls and expects to increase the output to one car of concentrates per week. The jigs are operated by hand power.

Pierce City—This company, operating near the Alice Dayton, recently installed a pump and resumed sinking the shaft, which is in good ore at the 80-ft. level.

Montana

BUTTE DISTRICT

Anaconda—The work of remodeling the hoisting engine at the Leonard mine for the use of compressed air is advancing satisfactorily, though it may be six weeks before operations are resumed. Leonard No. 1 shaft is being advanced from the 1800- to the 2000-ft. level; an air hoist is being installed on the 1800 to hoist ore from the 2000 to that level, where it will be transferred, by motor, to No. 2 shaft, and thence to surface. No. 2 shaft at present is 1800 ft. deep. The hoisting shaft of the West Colusa mine is also being sunk to the 2000-ft. level. The West Colusa was recently connected with the workings of the Mountain View mine on the 1200-ft. level by an east drift from the latter property. The air shaft at the Mountain View mine is now sinking about 180 ft. below the 1800. A station will be cut on the 2000-ft. level and a small pump installed to handle the water temporarily.

North Butte—Drifting on the Snowball vein is showing it to be an unbroken vein of good ore, and the North Crœsus vein is also showing well. A rich narrow vein of copper ore has been cut by the north crosscut on the 2400-ft. level. The crosscuts on the 2600- and 2800-ft. levels are being driven rapidly to intersect the Edith May and Jessie veins, which are expected to be cut soon.

CASCADE COUNTY

Florence Mining & Milling Co.—This newly organized company has secured the Florence mine, at Neihart. The mine is said to have produced $300,000, but was closed down some years ago. It consists of five patented claims, developed by several tunnels and a 400-ft. shaft. The property contains a strong, well defined vein, having the appearance of a true fissure, in gray feldspar gneiss, also several stringers and small branch veins, the ore being the richest at the junction of these stringers and the main vein. The ore consists of ruby silver, silver glance and brittle silver, in conjunction with chalcopyrite and galena. On the bottom level the orebody has a length of 600 ft., with an average width of three feet.

Boston & Corbin—During 1911, the company spent $80,000 in development and $8000 in construction. Opening work included: Drifting and crosscutting, 2463 ft.; raising, 282 ft.; shaft-sinking, 356 ft. A 10,600-cu.ft. station was cut at 922 ft. depth. Ore was opened on the 7th, 9th and 12th levels. About 50,000 tons are said to have been added to reserves since July 31, 1911. Ore is being developed between the 7th and 12th levels at the rate of about 650 tons per day, says Manager Emerson. The present reserves are stated to justify the erection of a 300-

ton concentrator. Preliminary tests on the ore by J. M. Callow indicate that a simple treatment is required, and it is estimated that the cost of the 300-ton plant will be less than $100,000. President Amster says that the directors deem it advisable that further tests on the ore be made before a decision as to the plant is reached. The report shows a surplus of $311,951 on July 31, 1911, and $9300 current indebtedness.

Lincoln County

Libby Placer Mining Co.—W. Hooten, superintendent, recently left Libby for the company's hydraulic plant, on Libby Creek. He took a force of men with him and will start work soon. Double shifts will be used, and the intention is to operate throughout the summer.

Nevada

Churchill County

Nevada Hills—The mill at Fairview is expected to resume at capacity about Apr. 15. All necessary connections have been made underground for handling the ore. The company is completing a hotel for the use of its employees.

Clark County

Marion—A crosscut to reach the vein at a depth of 300 ft. is being driven at this mine, north of the Fourth of July Mountains, in the Searchlight district.

Spokane—This Searchlight mine has opened ore in the Princess shaft at 300 ft., and the mill is expected to start soon. A. M. Jennings is in charge.

Searchlight—The only work on this mine is on the Dabu lease, under charge of Walter Wells.

New York-Searchlight—This company, doing development just north of Searchlight, has discontinued work without finding ore. J. M. Foote, of Newark, N. J., is president and W. W. Hurt is manager.

Comstock Lode

Union Consolidated—Two feet of good ore have been cut in the east crosscut from the north drift on the 2500-ft. level of the mine. The vein strikes east of north, and dips 70° east, the fracture being about 5 ft. wide, with 2 ft. of fairly solid quartz. This formation may be the footwall of the east vein. As soon as an air connection is made with the west crosscut from the 2500 station of the joint Union and Sierra-Nevada winze, the vein will be explored.

Mexican—Returns on eight bars of bullion netted the company $17,101. The mill has been operating steadily on ore from the surface dumps. Stoping has been resumed in the mine and last week 36 tons of $59 ore were taken from the 2300-ft. level and 103 tons of $28 ore from the 2400-ft. level.

Ophir—The 2500-ft. level has been pumped out by the Pumping Association, and a clay dam constructed in the north drift, near the old joint Ophir and Mexican winze, where two of the new electric pumps are to be installed. The company shipped a bar of bullion last week, worth $6700, secured from the cleanup of the drop boxes at the Kinkead mill, it having accumulated during the last run of 2000 tons.

Ward—A flow of about 250 gal. per min., of hot water, is being secured from the 2450 level, and in a recent round of drill holes, water spouted from each hole at the face. The extent of the water channel has not yet been determined. The pumps are handling a considerable flow of water, and are working in good condition.

Lyon County

Mason Valley—One furnace is in steady operation, and is treating considerably over 600 tons of ore per day. The original estimate for the furnace was 500 tons per day. Results are highly satisfactory and small independent mines are commencing to ship ore to the works in lots of from 70 to 150 tons.

Bluestone—W. B. Thompson, of New York, in company with several mining men of Salt Lake City, recently visited this mine, at Springton, owned by Capt. J. R. De Lamar, and idle for some time. It was reported that the purchase of the mine was contemplated, but we have been informed that such is not the case.

Nevada-Douglas—In March, the company shipped 8600 tons of ore to the Mason Valley smeltery, and 2300 tons during the first seven days in April. This is less than the amount called for by the contract, which is 10,000 tons per month. The ore runs from 3 to 7% copper, and carries little gold or silver.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Apr. 14, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,300	46,169
Tonopah-Belmont	1,950	30,676
Montana-Tonopah	1,053	13,924
Tonopah Extension	1,043	13,010
West End	700	9,749
Midway	.....	180
MacNamara	435	4,107
North Star	.....	40
Totals	8,481	117,855
Estimated value	$212,025	.....

Mizpah Extension—Drifting is in progress on the 1000-ft. level, on 2 ft. of $40 ore, believed to be an eastern extension of one of the Belmont veins.

MacNamara—A body of high-grade ore has been opened on the 375-ft. level and is from 4 to 7 ft. wide. Work has been commenced on a vein on the 800-ft. level, 30 ft. wide, by stoping for a length of 10 ft., the ore averaging from $10 to $25 per ton. The company's mill is treating about 60 tons of ore per day.

Montana-Tonopah—The Shaft vein, opened above the first intermediate level, has been shown to continue to the 515-ft. level, 240 ft. on its dip. The new vein cut on the 565-ft. level is from 8 to 10 ft. wide, averaging over $100 per ton. Another new vein cut on the 615-ft. level is 2 ft. wide and has been drifted on for 25 ft., averaging from $100 to $120 per ton. The mine now shows ore reserves sufficient to run the mill for two years.

West End—The production for March was worth $51,150, from milling ore, in addition to nearly 200 tons of high-grade ore shipped to smelteries. The mine has ore reserves equal to more than one year's milling and these are being increased. The company is free from debt and will soon commence work at the Ohio shaft, 1300 ft. west of its working shaft.

Tonopah Extension—The company is extending its western workings on the 500- and 600-ft. levels, on four shoots of ore assaying from $18 to $23 per ton, and from 3 to 10 ft. in width. Sinking of the new 3-compartment shaft, 400 ft. west of these workings, is making good progress. The mill is treating about 142 tons per day.

White Pine County

Boston-Ely—Contracts have been let for diamond drilling. Underground work will also be done below the bottom or 1245-ft. level. Considerable drilling will be done before sinking is resumed. It is hoped to find commercial ore below the water level.

Nevada Consolidated—The fourth annual report of the state railroad commission gives the total cost of the road and equipment of the Nevada Northern Ry., as $3,072,017. This line has 140 miles of main line and the net revenue for the year ended June 30, 1911, was $778,377. The greater part of the revenue is derived from the transportation of ore, of which 2,902,789 tons were handled during the year from the mines at Copper Flat and Veteran, to McGill.

New Mexico

Grant County

Oro Grande—It is reported that development work will be started on this group of claims. Some mining men are said to have become interested in the property and are furnishing the money for development.

Lucky Bill—Paul Larsh is shipping from 10 to 15 cars of ore per month from this mine to the El Paso smeltery. The lead contents are returning a profit and the vanadium is being held for future disposal. A car of 30,100 lb. of vanadium ore shipped to Europe averaged 7.19% V_2O_5, which was better than the guaran-

tee demanded. The price under which this shipment was made was 75c. per lb. f.o.b. Fierro, but this price has been reduced to $2.50 per lb. for actual metallic vanadium contents.

Chino—The third unit of the concentrator went into commission recently, marking the completion of the plant as originally designed. The machinery for the units to be installed, which will increase the capacity to 5000 tons per day, is on the ground and is being assembled.

SOCORRO COUNTY

Ernestine—The bullion produced during the last 10 days of March was 8850 oz.; concentrates, 12,000 lb. The total output for the month was 22,640 oz. of bullion and 16½ tons of concentrates, from an ore treatment of 3200 tons. The tonnage last week was 660. All developments in the mine are showing up well, the 300 level west being in especially good ore.

Deadwood—The plant is in full operation again, the repairs to the engine having been completed. During the absence of power, considerable water accumulated in the lower levels of the mine, which is now being unwatered, the upper workings furnishing the mill with ore in the meantime. A fair tonnage of custom ore is also being handled.

Tri-Bullion—A new orebody has been found on the Nit property of this company. Little is known regarding its width or length, but the ore is reported to be practically free from lime, with a good zinc content, and but little lead or silver. A trial run on the ore has shown that a good grade of zinc concentrates can be obtained.

Mogollon Gold & Copper—A new working lease has been let on the Little Charlie mine, to Los Angeles men. It is probable the other holdings of this company will be operated by the same men.

Oaks—Leasers on the Pacific mine are taking out a good tonnage of mill ore, largely from development, which amounts to about 40 ft. per week.

Oregon

Lucky Touville—Work is to be resumed at this copper mine, with a larger crew. The ore shows good assays. Col. Frank Ray, Medford, is interested.

Gold Hill—This company has recently been organized at Portland, for the purpose of erecting a custom mill, at Gold Hill, for the treatment of the ores in that section.

South Dakota

BLACK HILLS DISTRICT

New Reliance—Thirty stamps are now dropping at this property, on Annie Creek, including the 10 stamps recently installed. Since warmer weather has come, cleanups are improving. W. H. Weigand is superintendent.

Black Hills Grub Staking Concern—This is a South Dakota corporation, recently organized at Deadwood, with $26,000 of common stock and $24,000 of preferred stock. Its purpose is the advancement of mining development in the Black Hills region, by grubstaking prospectors for yearly terms, and assisting owners of property in developing ground.

Tennessee

Tennessee Exploration Co.—This company has been incorporated to make explorations, by drilling and otherwise, for zinc ore on a large tract of land, near Knoxville. J. D. Upton, of Reading, Mass., is president.

Texas

American Iron & Steel Co.—This company has been organized with a capital of $300,000 to develop iron-ore properties in Marion County that supplied ore to local furnaces many years ago. W. F. McClurg, of St. Louis, Mo., is a stockholder as are also W. B. Ward and B. F. Sherell, of Jefferson, Tex., where the company's office is situated.

Utah

Utah Co.—The company has announced a bond issue of $10,000,000, unconditionally guaranteed by the United States Smelting, Refining & Mining Co. The funds will be used solely to finance interests in valuable coal properties in Utah, and the construction of a second railroad outlet to connect with the Union Pacific Railroad.

BEAVER COUNTY

Majestic—It is stated that shipments from the Harrington-Hickory mine will be resumed soon. A recent trial shipment ran 5.29% copper and 3 oz. in silver.

Utah United—The Knight interests have acquired a large share of the stock of this company, operating in the Beaver Lake district.

Red Warrior—Two cars were shipped recently. The ore discovered on the 500-ft. level is reported to be 4 ft. wide, and has been followed 20 feet.

Beaver Star—The property consists of five claims in the Star district, a short distance north of the Hoosier Boy. There is a good surface showing, and development will begin soon.

JUAB COUNTY

Tintic shipments for the week ended Apr. 5 were 172 cars.

Iron Blossom—The company is shipping about 2000 tons per week and the monthly avearge of earnings for the last quarter is about $75,000. There is said to be about $150,000 in the treasury.

Eureka Hill—A lease has been given on the Shoebridge mill dump belonging to this company and containing from 700 to 1000 tons of ore, from which a profit of $3 per ton is expected.

Scranton—At a depth of 15 ft. the winze, which was being sunk from the Del Monte tunnel through lead ore, cut 5 ft. of zinc ore, assaying about 34% zinc, and carrying no lead.

Grand Central—Operations suspended for a week for repairs have been resumed.

SALT LAKE COUNTY

Utah-Apex—Electric haulage will be installed in the Parvenue tunnel, the main haulage way. The equipment has been ordered. There are 70 leasers working in the upper levels, and in the Phœnix ground now owned by the Utah-Apex.

Yampa—It is reported that the property has been examined recently by engineers for the Utah Consolidated.

Utah Copper—The output of the Arthur mill is 700 tons per section per day. The annual stockholders' meeting will be held Apr. 26 in Jersey City, New Jersey.

Montana-Bingham—A streak of good copper ore, with some gold and silver, is reported to have been opened in the tunnel, which is in 700 ft., the face being 350 to 400 ft. from the surface. The projected length is 4000 ft.; it is being built for drain, transportation and development purposes, and will afford considerable depth to the Bingham Amalgamated, Congor, Fortuna and Starless.

Michigan-Utah—On the 900-ft. level, in the Utah Mines Coalition, an orebody has been followed for 300 ft. to the west from a winze, which has shown the ore to continue to greater depth. There is considerable ore broken down and awaiting better weather for shipment.

Washington

FERRY COUNTY

Anaconda Gold Mining & Reduction—This company has been organized at Spokane, with a capitalization of $2,000,000; it has bonded the Fraction, Lucky, Ida, Ruby, First Thought, Last Shot, Minnie and Josephine claims, in the Republic district, and development work will be started soon. Arthur L. Flagg, Spokane, has charge of the work.

Swamp King—This company, with claims near Orient, is considering an offer from a North Dakota company for the lease of the property. The company is now controlled by Spokane men.

Gold Cube—This company, C. O. Perry, Addy, manager, will install new equipment, including an air compressor and drills this season, at its property in Stevens County.

LINCOLN COUNTY

A gold-bearing vein was recently reported as having been cut in a well being sunk near the town of Reardan. Exploration is said to be under way by Spokane men. This is an agricultural section.

Canada

BRITISH COLUMBIA

Granby—It is reported that work will start in May on the construction of a 2000-ton smeltery, at Granby Bay, Portland Canal district, the amount involved being about $1,000,000. A similar amount will also be expended on the development and equipment of the Hidden Creek mine. A surface tram will be used.

ONTARIO

Dispatches recently stated that iron ore has been found by diamond drilling near Fort Frances, at the western end of the province and just north of the international boundary.

Cameron Island—Preparations have been made to resume work at this mine in the Lake of the Woods district, which is already equipped with a complete plant and a 10-stamp mill. A syndicate of Toronto and Hamilton men have completed the necessary financial arrangements, and work will be done under the management of Fred Pfau.

ONTARIO-COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 12, and for the year to date, are:

	Week	Year
La Rose	63.10	902.30
Coniagas	120.15	546.35
O'Brien	....	199.78
Right of Way	....	110.34
Chambers-Ferland	....	96.00
McKinley-Darragh	34.54	789.11
Nipissing	40.20	473.12
Hudson Bay	30.54	218.40
Buffalo	....	294.21
Crown Reserve	....	140.11
Cobalt Townsite	55.50	320.31
City of Cobalt	....	113.14
Trethewey	....	147.06
Colonial	....	20.00
Kerr Lake	54.28	231.48
Cobalt Lake	....	136.01
Drummond	....	300.32
Temiskaming	38.40	260.37
Beaver	30.00	101.99
Wettlaufer	28.43	111.21
Provincial	....	22.22
Casey Cobalt	....	24.50
Totals	491.57	5,769.47

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to date
Nipissing	39,411.00	1,124,500.52
Trethewey	1,696.18	5,703.66

Nipissing—The sampling plant was destroyed by fire on Apr. 10, entailing a loss of $5000 covered by insurance. It is being rebuilt. March shipments were valued at $257,706, of which $230,305 represented bullion. Production for the month amounted to 386,978 ounces.

McKinley-Darragh—In drifting from a winze sunk 60 ft. below the 150-ft. level, a vein 2 to 3 in. wide, of 2500-oz. ore, was cut near the Princess line.

La Rose Consolidated—The annual report for 1911 shows a deficit of $5770. The combined subsidiary companies show a surplus of $642,086 compared to $596,408 for 1910. On Dec. 31, 1911, La Rose cash amounted to $1,277,805. Exploration work was satisfactory, but a well defined fault has been found to extend through the mine, west of which no ore was found.

ONTARIO-PORCUPINE

Pearl Lake—This company has closed down for lack of funds.

McIntyre—It is expected that an issue of treasury stock at $6.50 per share will be made soon. The par value of the stock is $5. The company will add 20 stamps and a tube mill to its present equipment to be ready by June 1, giving a total mill capacity of 160 tons per day.

Rea—All underground work has been stopped, pending the annual meeting of the company on Apr. 17, at Montreal, when complete reports of the results of operations will be presented by Manager Bergstrom.

Keora—A small steam plant is being installed on this property.

Hollinger Reserve—A compressor plant and steam hoist are to be installed on this property. When it is in operation, the main shaft will be continued to 200 feet.

Dome Lake—The company has decided to install a 10-stamp mill. The process to be adopted will be determined when test runs on the ore extracted have been made.

Dome Extension—The crosscut in the workings from shaft No. 4 is in 90 ft., of which 63 ft. are in quartz and schist. The first 27 ft. carry ore of milling grade.

Preston-East Dome — The financial statement submitted at the first annual meeting, Mar. 27, showed liabilities of $6500, and $55,010 cash on hand. The amount spent on development was $30,821. The loss by the fire of last July was $20,584. The engineer's report showed that the main shaft was down 115 ft., and that crosscutting had been commenced at the 100-ft. level and carried in 15 feet.

Bewick-Moreing—No. 1 camp, the last operated by this company, has been closed down, and it is understood that the company is retiring from the Porcupine field.

Hollinger—In hunting for No. 4 vein on the 200-ft. level, the vein was entirely passed through before it was observed to be No. 4. It was only found by erratic assays, taken along the walls of the crosscut, and it was finally necessary to wash down the walls of the crosscut in order to see where the ore came from. The crosscut is believed to have been driven through a fault plane standing at about 70°, so that the two sections of the vein were on either side.

QUEBEC

Bell—On Apr. 6, Pierre Leviner was killed, William Doyle fatally injured and Eugene Nadeau seriously injured by a premature explosion while the wires of an electric battery were being connected at this asbestos mine at Thedford.

Mexico

JALISCO

San Pedro Analco—This property, on the Santiago River, in the Hostotipaquillo district, is under investigation by Messrs. Brown and Onelos, engineers representing English interests, that are said to have an option on the property. The property is extensively developed and is equipped with a hydro-electric power installation. It has been idle for some time.

MEXICO

El Oro—During March, the mill treated 21,300 tons of ore and 11,410 tons of tailings, yielding bullion, $172,120. Working expenses were $96,720; development, $22,110; permanent improvement, $1150; and $62,110 total profit.

OAXACA

Conditions in the latter part of March were satisfactory in this state. The Houston mill is in course of erection, the machinery has been shipped for the Cubilete mill and the designs for the San Juan mill are being completed, after exhaustive metallurgical tests. The Santa Catarina mill has been repaired and enlarged and is now working.

Alvarado—The company at the end of March was still operating with no trouble. Mill tonnage is normal and of good grade. Pumping has not been interrupted. If cyanide can be obtained, operations will probably not be suspended.

South America

BRAZIL

New diamond fields are said to have been found on the Garzas River in the State of Goyaz.

BOLIVIA

Activity has been shown in the Huanuni tin-mining district. The interests of Peny and Duncan have been transferred to a native capitalist for a large amount, marking the end of boundary litigation.

SALVADOR

Monte Mayor Gold & Silver Mining Co.—This company has recently acquired properties in the Department of Morazan, about six miles from the San Sebastian mine and about eight miles from Sociedad. Machinery has been ordered and some has been received. The company expects to use the cyanide process. MN—

Africa

TRANSVAAL

Gold production in the Transvaal in March made a new high record, reaching a total of 820,782 oz., or $16,965,564. This was 126,866 oz. more than in February. For the three months ended Mar. 31, the total was 1,937,920 oz. in 1911, and 2,373,649 oz.—or $49,063,325—in 1912; an increase of 435,729 oz. this year.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Apr. 17—The coal trade in the West seems to be gradually settling down into better shape, with the prospect that there will soon be a general resumption of mining. No further obstacles have arisen to the general settlement, and the prospect is that matters will resume their normal condition before long.

The seaboard bituminous trade is also approaching its normal position, though prices are unsettled, partly because of the anthracite troubles, and partly because of an increased demand for export.

The anthracite-labor question is still in the air. At the conference last week Mr. Baer offered a plan to submit the questions in dispute to arbitration by the surviving members of the Anthracite Strike Commission of 1902. This was rejected, and a committee of four operators and four miners was appointed to prepare a compromise, if possible. The miner and operator members have been at work separately and meet today in conference to compare their respective plans and then submit the result to the larger bodies of representatives. The result is uncertain, but there seems to be a rather sanguine feeling as to the probability of a settlement. The main trouble is over the recognition of the union.

German Coal Trade—Exports of fuel from Germany two months ended Feb. 29 were: Coal, 5,174,207; brown coal (lignite), 9485; coke, 797,266; briquettes, 415,186; total, 6,396,244 metric tons. Imports were: Coal, 1,401,587; brown coal, 1,162,821; coke, 91,663; briquettes, 33,362; total 2,699,435 metric tons.

Coal production of German Empire two months ended Feb. 29, metric tons:

	1911	1912	Changes
Coal.....	26,196,203	29,209,910	I. 3,013,707
Brown coal.....	12,138,748	13,371 957	I. 1,233,209
Total mined..	38,334,951	42,581,867	I. 4,247 916
Coke made.....	4,227,013	4.611,648	I. 384,635
Briquets made.	3,466,888	3,832,660	I. 365,772

Of the briquettes reported this year 2,966,806 tons were made from brown coal, or lignite.

Iron Trade Review

New York, Apr. 17—The iron and steel markets continue active for the most part, and new business continues to come in, with indications of a good spring trade.

In finished material almost all kinds of steel are in demand, and there are indications that buyers are disposed to fill up their stocks and take contracts further ahead. Bars seem to be wanted, while plates and structural steel continue to be called for. Several rail contracts are noted, including one of 100,000 tons for the Southern Pacific lines, of which 40,000 tons will go to the Ensley mills, 20,000 to Pueblo and the rest to Eastern mills. Car and railroad-bridge orders are also on the increase. Prices are gradually strengthening.

Pig iron has been a little less active, but there have been some large sales of bessemer and basic, with further inquiries pending. Foundry iron is not so strong, though there are many small sales. Pig-iron prices are firmer, but buyers seem to have successfully resisted any large advances.

The Steel Corporation's statement of unfilled tonnage on the books on Mar. 31 gives a total of 5,304,841 tons, a decrease of 140,359 tons from Feb. 29. This is not at all unfavorable, in view of the heavy operations in March.

Baltimore

Apr. 15—Exports for the week included 11,767,175 lb. castings, structural steel, miscellaneous iron and steel to Panama. Imports included 74 casks silicospiegel, 1730 tons ferromanganese and 100 tons spiegeleisen from Liverpool; 62 casks manganese ore from Hamburg; 2397 tons cupreous pyrites from Huelva, Spain; 22,565 tons iron ore from Cuba.

Birmingham

Apr. 15—Southern pig-iron manufacturers are selling their product right along for delivery during the third quarter of the year with some business being booked also for fourth-quarter delivery. The quotations are firm at $11 per ton, No. 2 foundry, as the basis. Some of the manufacturers are confident there will be a better price when the buying is on for last-quarter delivery. In addition to the 66,000 tons of iron sold just before the start of the present month, it is announced that an Eastern pipe concern has placed an order for 25,000 tons of iron with Southern furnace companies for delivery during the latter part of the year. A number of smaller orders have been placed.

The make in Alabama in March was nearly 150,000 tons against 138,000 tons in February. The two days' difference had something to do with this increase. The make in April should be equal to that of March at least, if not a little better as the weather conditions have been favorable.

The steel situation also is a little improved, though the plant of the Tennessee company at Ensley is not yet working on full time. Fabricated steel is in strong demand.

Charcoal iron shows no change; $22@22.50 is the price. The make is still limited.

Chicago

Apr. 16—Sales of pig iron continues large in comparison with those in previous weeks, but there is nothing as yet in the nature of a boom. The tendency of the melters is to buy more freely than for a long time. Both Southern and Northern irons are in demand to a degree that encourages sellers, who are asking more for last-half deliveries than the average buyer is willing to give; but the number of exceptional buyers, willing to take a chance and to buy on a strengthening market, seems to be increasing. As a whole, the market may be said to be notably stronger and to be acquiring still more strength.

Southern No. 2 pig iron holds to $10.50@11, Birmingham—$14.85@15.35, Chicago—on all except the most favorable sales to the seller, who makes a minimum price of $10.50—and Northern No. 2 brings $14.50 in general—a few sales perhaps being 25@50c. less—with Lake Superior charcoal quiet but firm at $16.50 minimum. These prices apply to second- and third-quarter business; for last-half requirements in general and for fourth-quarter the higher quotations obtain. In general, it may be said, the consumer of pig iron is buying more liberally and gradually extending the time of his deliveries; the seller is cautious and seeks a higher price on deliveries any considerable distance in the future, in the belief that the market is rising.

The market for iron and steel products seems to be stiffening generally. Structural material is active and strong. Bridge and building needs are large and increasing, for business throughout the West and Southwest, the price holding to 1.35c. for material under 15 in. The bar business is still ragged, with some business probably placed under the nominal minimum of 1.33c. quoted, but general conditions holding the market rather closely to that figure. Iron bars are not so active as steel bars, prices holding to 1.15@1.20c. Plates find increasing sales in view of strengthening railroad demands, at 1.35c. minimum on ¼-in. tank plates. Railroad supplies are

quiet, but track fastenings continue in good demand and there are some inquiries that may result in good-sized orders for light rails. Sheets have a better sale and wire goods are active in consequence of farm needs. General business improves steadily, though slowly.

Cleveland

Apr. 15—Iron-ore sales have been large. A number of vessels have been chartered to carry ore from the head of the Lakes to Cleveland at 40c. net—that is, 40c. and the unloading charge, whatever that may be fixed at. Whether it will be 10 or 8c. seems uncertain.

Pig Iron—Sales have been large, but there seems to be little or no change in prices. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.90 for basic, $13.25@13.50 for No. 2 foundry and $12.50@12.75 for gray forge.

Finished Material—Sales are good, especially for bars, plates and structural steel. Quotations are now pretty firmly held at 1.15c. on bars and 1.20c. on shapes.

Philadelphia

Apr. 17—The heavy transactions in basic and bessemer in Western markets have reflected a stronger tone in this market in all lines of pig iron. Within a day or two inquiries for large lots have come from unexpected quarters, large consumers who recently have been quite liberal buyers. Large inquiries for both bessemer and basic are now before makers and transactions are practically assured. Iron for steel making is more active than any other kind and even foundry, which has been dragging for some time, is in good request. Several orders have been placed for low-grade iron for pipes. Forge iron is moving more freely. Inquiries from New England are quite liberal and the entire market has just put on spring activity. Quotations are: No. 2 X foundry, $15@15.25; gray forge, $14@14.50; basic, $14.50. Southern brands are selling pretty close to these figures.

Steel Billets—The increase of exports inquiries is stimulating domestic buyers, and quite a number of large concerns have hurried into the market and closed for good sized lots at prices stipulated a week or two ago. The outlook for rolling billets is especially good. Forging billets are being called for more freely than for months.

Bars—An advance has taken place in bars to 1.32½c. for refined, which is a minimum price and higher figures are paid for small lots. An influx of small orders during the past week has spread a feeling of hopefulness in the bar mills. The inquiries some of them have received for summer delivery are particularly encouraging.

Sheets—Sheets have advanced $1 or $2 a ton in large lots with a greater advance in small lots. Several good sized orders have been placed, deliveries extending over the summer. Corrugated leads other kinds in activity.

Tubes—Tubes are more active than they have been for months at recent discounts, and an upward tendency is manifest.

Plates—Car builders are active buyers to provide for recent and prospective contracts, and some heavy orders have been placed, in which deliveries have been specified to begin in some cases early in May. Some of the contracts extend into August. The shipbuilding interests have also closed for large lots of material.

Structural Material—Some business which has been hanging fire for two or three months has been finally placed, calling for deliveries of bridge steel. The distribution is mainly over the Atlantic slope, and not a little of the business is in small lots, for small bridges and for terminal railway work, as well as for building operations.

Steel Rails—The large orders for steel rails, which have recently been placed, have not done Eastern mills much good. There are inquiries on the market for moderate-sized lots to complete minor track laying.

Scrap—An active demand is maintained and nearly all concerns using scrap are buying liberally. Railroad is scarce and has been nominally advanced. A lot or two of steel carwheels have been picked up. Melting scrap is in short supply. Heavy cast scrap is being called for and supply is sufficient, but it commands 50c. a ton more.

Pittsburg

Apr. 16—Mills are showing such a disposition to advance finished-steel prices that it is perfectly apparent they are indifferent to booking additional tonnage at the moment. As a rule they have their output sold to July, and are advancing prices at this time in order to realize a better average on their shipments in the third quarter. Of course, a limited amount of tonnage is sold at advanced prices for early delivery, but as a rule buyers will not begin paying the advanced prices until third quarter.

The Carnegie Steel Co. has notified the trade that on Apr. 20 its price on steel bars will advance from 1.15c. to 1.20c. Meanwhile, it is willing to contract at 1.15c., with jobbers for the usual 90 days ahead and with manufacturing consumers to Oct. 1. Such buyers, however, are already fairly well covered for the periods mentioned. The periods mentioned are for filing specifications, deliveries following according to the condition of mill order books. The Republic company advanced its price to 1.20c. today.

Effective Apr. 11, the American Sheet & Tin Plate Co. advanced its minimum prices from 1.85c. to 1.95c. on black sheets, from 2.90c. to 3.00c, on galvanized sheets, from 1.35c. to 1.40c. on blue annealed, and from $2.50 to $2.55 on galvanized corrugated roofing. It had a few weeks earlier made advances on black and galvanized sheets. The market was standing practically at the company's prices before the advance, and the new prices do not become the market as independents are still selling at the old figures to an extent, but it is believed that within a short time the whole market will be up to the new basis.

On Thursday, Apr. 18, the American Sheet & Tin Plate Co. will inaugurate the practice of selling all corrugated, V-crimps and other formed roofing by the pound instead of by area. This is pursuant to a plan considered for several years, for the purpose of discouraging the practice of misrepresenting the gage. A great deal of material is sold lighter than the gage marked, and it is believed that the change to selling by weight will stop this. Other manufacturers will gradually fall in line. The company's price system is a very simple one, as for corrugated material there is added 5c. per 100 lb. to the price of the black, for gages 12-18, inclusive; 10c. for 19-24 and 15c. for 25-28. Thus No. 28 will be quoted at 2.10c. per lb., since 28-gage flat sheets are held at 1.95c. As a square of 28-gage painted should weigh 68 lb., this will make a price of $1.36 for a square, but the billing will be by the actual weight, and the buyer will have to compute how much weight is required to cover the desired area.

There seems to be a definite movement on the part of manufacturers of bars, plates and shapes to work the market up to a level of 1.20c. for bars and 1.30c. for plates and shapes. As soon as the market is well lined up on this basis of 1.20c. for bars, one or other of the mills will probably announce a similar advance in plates from 1.20 to 1.25c., and this will be kept up until both plates and shapes are on a 1.30c. basis.

The advancing tendency in prices is having such an effect upon the filing of specifications that the mills are very well filled, and there is no index as to the fundamental strength of the market, as buyers may easily specify for more material than they really need, when they see that they cannot replace it at their contract prices.

Pig Iron—The market has been slow in point of sales and inquiries, but prices are absolutely firm and the outlook is regarded as good by the merchant furnaces in operation. They are not, as a rule, anxious for any advances in price, as they fear this would bring in some of the idle furnaces and the market might even-

tually decline to a still lower level. The inquiry of the Andrews Steel Co., Newport, Ky., for 15,000 tons of basic iron, was mentioned in last report. The company has since bought 20,000 tons, for second-half delivery, but did not take any of it from Valley furnaces. It is understood the delivered price was not over $14.20, which would be equivalent to $12.40, Valley. The iron probably came from Columbus or Toledo furnaces. We quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; gray forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg, for early delivery, furnaces as a rule asking higher prices for delivery after July 1 next.

Ferromanganese—The English producers yesterday announced an advance of $2.50. No definite information was available in advance, but for some time past it has been thought that another advance was contemplated. Deliveries have been poor in the past few weeks, the furnaces having difficulty in getting material to seaboard, while vessel room was also hard to secure. As a result, prompt metal has been quite scarce, and has frequently brought $44 or $45 a ton, Baltimore, while as high as $46 was paid in one instance. On the other hand, it is stated on excellent authority that within a few days a sale of prompt metal was made at $41. We quote prompt delivery at $44@45, and forward delivery at $43.50, Baltimore. The price holds good for deliveries into next year.

Steel—The western Pennsylvania mills are practically all out of the market, being already oversold, and the market, such as it is, is made by one or two sellers at Youngstown. There are no free sellers anywhere, and it is a question what would have to be paid for either billets or sheet bars. We quote nominally $20 on billets and $21 on sheet bars, Pittsburg, though it is possible a close buyer might pick up a little tonnage at less. Rods are $25, Pittsburg.

Sheets—The market is firmer since the American Sheet & Tin Plate Co. advanced its minimum prices, effective last Thursday. Its minimum prices now are: Blue annealed, 10 gage, 1.40c.; black, 28 gage, 1.95c.; galvanized, 28 gage, $3; painted corrugated roofing, $1.35 per square; galvanized corrugated, $2.55. On Apr. 18, its prices on corrugated roofing will be 2.10c. per lb. on 28-gage painted and 3.15c. per lb. on 28-gage galvanized, as already explained. The independents have continued to firm up, by one low price after another being withdrawn, and we quote the market now as follows: Blue annealed, 1.35@1.40c.; black, 1.85@1.95c.; galvanized, 2.90@3 cents.

St. Louis

Apr. 15—More activity has developed in the market for pig iron and sales have been larger than for some time. Inquiries running over the second half of the year continue to come in. Prices are firmer. Southern No. 2 foundry is held at $10.50, Birmingham, or $14.25, St. Louis, while Northern No. 2 is quoted at $14.50@14.75 per ton.

Coke is in rather short supply, and is coming in slowly. Quotations are $5.10@5.20, St. Louis, for good foundry.

Business in finished iron and steel is improving, with more sales and prices a little firmer.

Iron Ore Trade

Heavy sales of Lake ore are reported from Cleveland. It is stated that from 8,000,000 to 10,000,000 tons have been sold or resold up to date; and that nearly 1,000,000 tons of the total have been taken by Eastern furnaces. Prices are as heretofore stated, except that some cuts have been made on ore sold to Eastern companies. Lake-vessel rates are prettty well settled at 40c. from Duluth or Superior to Lake Erie, plus the unloading charge. There is talk of fixing that charge at 10c., but protests have been made, and 8c. seems more probable. A heavier tonnage than 1911 is expected.

Foreign Iron Trade

German Iron Production—Pig-iron production in the German Empire in February was 1,319,827 metric tons, being 52,922 tons less than in January. For the two months ended Feb. 29 the total was, in metric tons:

	1911	1912	Changes
Foundry iron	509,645	485,114	D. 24,531
Forge iron.....	97,414	90,084	D. 7,330
Steel pig.....	278,635	357,766	I. 79,131
Bessemer pig.....	57,601	55,991	D. 1,610
Thomas(basic)pig	1,556,554	1,703,621	I. 147,067
Total.....	2,499,849	2,692,576	I. 192,727

The total increase was 7.7%. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

Metal Markets

New York, Apr. 17—The metal markets have been again comparatively quiet, but are generally strong, though business has been less active.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Feb. 1912..	$ 10,589,295	$ 2,937,274	Exp. $7,652,021
" 1911..	424,733	5,805,844	Imp. 5,381,111
Year 1912..	12,504,497	8,078,517	Exp. 4,425,980
" 1911..	1,348,409	15,346,674	Imp. 13,998,265
Silver			
Feb. 1912..	5,121,776	3,780,477	Exp. 1,341,329
" 1911..	4,453,171	3,897,946	Exp. 555,225
Year 1912..	11,149,681	8,138,486	Exp. 3,011,195
" 1911..	10,104,247	7,449,372	Exp. 2,654,875

Exports from the port of New York, week ended Apr. 13: Gold, $350,100, largely to Argentine; silver, $706,589, mostly to London and Paris. Imports: Gold, $309,354; silver, $52,272; from Mexico, South America and Australia.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is some talk of shipments of gold from Europe to New York, but none has yet been made. In New York some small amounts were shipped to Argentina.

Platinum—The market is quiet and nothing seems to move it. There has been some talk of lower prices, but it is not easy to see upon what such an expectation is based. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal, up to 10% iridium.

Silver—The market remains steady with a slight upward tendency. There is no movement of any special significance to record.

SILVER AND STERLING EXCHANGE

Apr.	11	12	13	15	16	17
New York....	58⅜	58⅛	58⅜	58⅜	58⅛	58⅜
London	27	26⅞	27	26⅞	26⅞	27⅛
Sterling Ex..	4.8695	4.8690	4.8700	4.8700	4.8710	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to April 4, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£2,724 200	£1,830,800	D. £893,400
China.....	702,800	465,000	D. 237,800
Total	£3,427,000	£2,295,800	D. £1,131,200

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Apr.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
11	15⅞ @16	15.70 @15.80	43¼	4.20	@4.12½ 4.15	6.50 @6.70	6.35 @6.55
12	15⅞ @16	15.70 @15.80	43¼	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55
13	15⅞ @16	15.70 @15.80	43¼	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55
15	15⅞ @16	15.75 @15.85	43⅜	4.20	4.12½ @4.15	6.55 @6.75	6.40 @6.60
16	15¾ @16	15.75 @15.85	43½	4.20	4.12½ @4.15	6.55 @6.75	6.40 @6.60
17	15⅞ @16	15.80 @15.85	43½	4.20	4.12½ @4.15	6.65 @6.75	6.50 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
11	70 7/16	71 5/16	75¼	197½	194¼	16 3/16	25⅛
12	70⅜	71⅛	75¼	197¼	194	16 3/16	25⅜
13	.....	.....	.....	.....	.....	.....	.....
15	70⅜	71¼	75¼	197½	194⅛	16¼	25⅞
16	70⅝	71½	75¼	197½	194⅜	16¼	25⅞
17	70 11/16	71 3/16	75¼	197¾	194⅜	16 5/16	25⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been rather dull during the week Apr. 11-18, but even the relatively small demand has resulted in a further stiffening of prices. There have been some reports of sales of electrolytic at concessions by second hands, but it is not believed that these amounted to much. All of the first hands have maintained their prices firmly at 16c., delivered, both for domestic and foreign shipment. One large seller raised its quotation to 16⅛c. on Apr. 16, but no business at the advance has yet been reported. The demand for copper during the week has been more from domestic than foreign sources; apparently the speculative interests abroad are taking care of business in that quarter.

Consumption both here and abroad continues excellent, and the European statistics for the first half of April showed a decrease, the visible supply being about 740 tons and the stocks 140 tons less than at the beginning of the month. Little has been done in Lake copper, which is quoted nominally at 15⅞@16c. Electrolytic copper is somewhat firmer, and at the close cakes, ingots and wirebars are quoted 15.80@15.85c. Casting copper is quoted nominally at 15½@15¾c. as an average for the week.

The London standard market has been fluctuating within narrow limits, and closes practically unchanged at £70 6s. 3d. for spot, and £71 3s. 9d. for three months. There have been considerable realizations by speculative holders, the offers being readily absorbed.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 3568 long tons. Our special correspondent gives the exports from Baltimore at 1201 tons.

Visible stocks of copper in Europe, on Apr. 15, are reported as follows: Great Britain, 35,520; France, 6490; Rotterdam, 3050; Hamburg, 7600; afloat from Chile, 1930; afloat from Australia, 5500; total, 60,090 long tons, a decrease of 990 tons from the Mar. 31 report.

Tin—The market remained firm throughout the week, with but slight variations. A good deal of cheap tin was offered in this market, a liberal supply of spot tin being on hand and large shipments coming in. This was quickly taken advantage of by consumers, who also bought June and July deliveries. The market closes steady at £197 15s. for spot, and £194 10s. for three months in London, and about 43½c. for April tin in New York.

Lead—More business is reported at the last prices, 4.20c., New York, and 4.12½@4.15c., St. Louis.

In Europe, the market for lead is firmer, Spanish lead being quoted at £16 6s. 3d., and English 2s. 6d. higher.

Spelter—There has been more demand, both for early and for future shipment, and the market is firm and slightly higher at 6.50@6.60c., St. Louis, and 6.65@6.75c., New York, according to the delivery. There is still a wide spread in prices, and the sales at the higher prices are not heavy.

The London market is also somewhat firmer, good ordinaries being quoted at £25 17s. 6d., and specials at £26 2s. 6d. per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quiet and unchanged at 7⅛c. per lb., New York.

On a specification by the U. S. government for 50,000 lb. of Bertha or Horse Head spelter, delivered in Washington, D. C., the New Jersey Zinc Co. last week made an offer at 8¼c. per pound.

Other Metals

Aluminum—Business is quite active and prices are firm at last quotations, 20@20½c. per lb. for No. 1 ingots, New York. A late London quotation is £62 per ton—equal to 13.33c. per lb.—for ingots.

Antimony—Business has been better than in recent weeks. Cookson's is a shade firmer at 8@8⅛c. per lb. Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—The New York price has been reduced slightly and is now $41@42.50 per flask of 75 lb., with the usual advances for small quantities. Business is brisk at the decline. San Francisco, $41.50 for domestic orders and $39 for export. London price is £8 12s. 6d. per flask, with £8 7s. 6d. quoted from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 13—The high price of zinc sulphide ore was $58, the base, per ton of 60% zinc, $50@55.50. Zinc silicate sold at $25@28 per ton of 40% zinc. Average price, all grades of zinc, $50.30 per ton. A weaker lead-ore market, with $55 high, brought the average down to $53.70, a decline of $1.30 per ton.

Outputting conditions are more assuring, so far as the weather is concerned, but the water-soaked earth is proving very treacherous in many of the soft mines, and accidents seem to be frequent. So far there have been few serious ones. Producers attempt to use every precaution, but the break will generally occur in the least expected place. These conditions have always followed such a long

SHIPMENTS, WEEK ENDED APR. 13

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,123,760	.....	1,589,290	$150,150
Joplin	1,617,930	.....	276,570	51,150
Alba-Neck	1,234,080	130,000	95,030	39,060
Galena	740,120	.....	152,330	22,610
Miami	465,960	.....	258,050	17,225
Oronogo	580,430	.....	59,000	15,795
Granby	331,100	450,150	13,450	13,465
Duenweg	401,810	130,000	39,190	13,400
Cave Springs	371,320	.....	.....	10,395
Carl Junction	265,220	.....	.....	7,670
Spurgeon	61,140	131,200	109,680	6,410
Jackson	119,550	.....	6,630	3,220
Wentworth	103,270	.....	.....	2,565
Carthage	87,370	.....	.....	2,350
Lawton	.....	.....	62,610	1,490
Totals	10,503,060	841,350	2,671,780	$357,075
15 weeks	149,901,590	8,949,850	25,369,380	$4,361,721
Blende val., the week, $272,480; 15 weeks, $3,543,870				
Calamine, the week, 12,855; 15 weeks, 127,857				
Lead value, the week, 71,740; 15 weeks, 699,977				

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.9
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	.....	37.47	.....	56.37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

wet spell as this spring, and cause some loss of time. This will be followed by bad air when the weather warms a little more, in such mines as are not provided with excellent ventilation. Still the output may be maintained around 5300 to 5500 tons.

Platteville, Wis., Apr. 13—The highest price paid this week for zinc ore was $55 per ton; the base price, 60% zinc, was $53@54. The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 13

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	1,026,300	.....	.....
Hazel Green	401,000	.....	.....
Galena	378,100	.....	.....
Benton	323,300	.....	346,900
Platteville	224,400	.....	100,000
Cuba City	195,000	174,530	.....
Livingston	180,000	.....	.....
Rewey	84,000	.....	.....
Shullsburg	80,000	.....	.....
Linden	60,000	.....	66,260
Total	2,952,100	174,530	513,160
Year to date	56,361,740	1,621,860	6,160,350

Shipped during week to separating plants, 1,726,950 lb. zinc ore.

Chemicals

New York, Apr. 17—The general market is unchanged and fairly active.

Copper Sulphate—Business is on a fair scale. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand still continues up to supply, perhaps in advance of it. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is active and rather strong, but quotations are unchanged at 2.40c. per lb. for spot, and 2.35@2.40c. for future positions.

Petroleum

The monthly report of the *Oil City Derrick* gives new oil wells completed in March as follows: Pennsylvania and West Virginia, 313; Lima-Indiana, 31; Kentucky, 19; Illinois, 54; Kansas and Oklahoma, 408; Texas and Louisiana, 96; total, 921. In all the divisions there were 921 wells completed, 80 more than in February. The new production was 44,902 bbl., an increase from the February report of 1377 bbl. There were 165 failures among the completed wells, and 78 gas wells, a total of 243, leaving 678 oil producers.

On the last day of March there were 503 rigs up and 1088 drilling wells, a total of 1591. This was an increase of 53 in rigs and 132 of wells drilling.

Mining Stocks

New York, Apr. 17—On Apr. 11, the Exchange was active, but a little inclined to recessions on all but a few favorite stocks. The Curb did a good business and mining stocks generally were in favor. Copper shares were irregular, some advancing and others declining.

Apr. 12 there was rather a halting market, with many recessions in price. The industries were stronger than other stocks. On the Curb, sales were slower and the market inclined to be heavy. Prices were variable for copper stocks, but the general tendency was to lower quotations.

Apr. 13 the market opened rather heavily, but recovered tone later and closed fairly strong. The Curb did a fair business in mining stocks, chiefly coppers, which showed considerable strength.

Apr. 15 the market took an upward turn. The copper stocks listed on the Exchange all advanced and were in demand. Trading in mining stocks on the Curb increased and broadened out, almost all selling at advancing prices. The copper stocks especially sold at higher quotations.

Apr. 16 trading halted, not for any specific reason, apparently, except for a purely sentimental cause, the general gloom cast over the market by the "Titanic" disaster. There was little reaction, but slow trading. The Curb also was rather inactive and trading was quiet and irregular. Apr. 17 the market had not yet recovered its tone and trading was again on a smaller scale, and with few changes, either on the Exchange or the Curb.

Boston, Apr. 16—Another week of activity and strength has been witnessed in copper shares. The sharp advances in some specialties have been well maintained, while reactions have tended to strengthen the technical position of the general copper share list. Public interest is increasing in metal stocks as a big volume of business attests. Many specialties have made record prices on the current movement and still further optimism is encouraged by the strength maintained in the metal itself.

The most conspicuous advances during the week are those made in Granby and Tamarack. The former rose $12.75 to $56.50 and the latter $12 to $42, although all of the advances mentioned were not maintained in today's uneven market. The Granby has got an immense tonnage in sight and the Tamarack has reduced costs 3c. per lb. to a point where the present level of copper gives a good margin of profit. Some of the lesser stocks like Adventure, Indiana and New Arcadian have had sharp movements with a large amount of trading. Adventure is working in rich copper territory and Arcadian has encountered good ore at depth. Indiana has struck rich ore in the crosscut on the 600-ft. level.

Butte & Superior has attracted attention with a $2 advance to $33. The company has voted to offer 30,000 shares of new stock to holders of record Apr. 27 at $27.50 per share. The issue is underwritten. Ahmeek Mining has taken its 50,000 shares from the Curb and listed them on the Stock Exchange.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	.....	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd	3,200,000	3,020,000	3,150,000
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	.....
Mammoth	1,665,319	1,722,954	.....
Mason Valley	600,000	1,100,000	.....
Nevada Con	6,309,228	4,888,790	.....
Old Dominion	2,044,000	2,039,000	.....
Ray	2,475,945	2,140,000	.....
Shannon	1,550,000	1,300,000	1,388,000
South Utah	189,678	283,838	299,000
United Verde*	2,000,000	2,250,000	.....
Utah Copper Co	8,156,612	8,612,739	.....
Lake Superior*	17,500,000	19,000,000	19,750,000
Non-rep. mines*	8,400,000	8,000,000	8,400,000
Total production	98,896,026	.....	.....
Imports, bars, etc	31,790,590	18,976,513	.....
Total blister	130,686,616	.....	.....
Imp. in ore & matte	8,340,740	10,432,438	.....
Total	139,027,356	.....	.....
Miami	2,235,647	2,475,996	.....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	.....
Granby	1,607,558	1,773,496	.....
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	2,948,000	2,834,000
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	725,760
Kyshtim, Russia	.....	.....	.....
Spassky, Russia	795,200	649,600	.....
Famatina, Argen	172,480	.....	.....
Tilt Cove, Newf'd	153,257	109,059	104,992
Exports from:			
Chile	8,064,000	6,720,000	3,584,000
Australia	7,056,000	7,164,000	8,064,000
Arrivals in Europe†	13,144,320	10,868,680	12,559,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566

	Visible Stocks		
	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

Speculation in Mayflower and Old Colony has subsided somewhat, although prices are well maintained. The Fay management in Mayflower will be succeeded by the younger Mr. Paine.

Business on the Curb has been active and prices generally strong.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1		$0.005
Algomah, Mich	Jan. 22		1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah,	Feb. 6		0.01
Boston Ely, Nev	Jan. 18		0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20		0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Ely Con., Nev			0.05
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28		1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29		0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16		0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10		1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1		0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz	Jan. 15		1.00
Union Con., Nev	May 9	May 31	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325		24.483	24.595	
May	53.870	53.308		24.797	24.583	
June	53.462	53.043		24.651	24.486	
July	54.150	52.630		25.034	24.286	
August	52.912	52.171		24.428	24.082	
September	53.295	52.440		24.567	24.209	
October	55.490	53.340		25.596	24.594	
November	55.635	55.719		25.680	25.649	
December	54.428	54.905		25.160	25.349	
Year	53.486	53.304		24.670	24.592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019		12.275		54.034	
May	11.989		12.214		54.313	
June	12.385		12.611		56.365	
July	12.463		12.720		56.673	
August	12.405		12.634		56.266	
September	12.201		12.508		55.253	
October	12.189		12.370		55.170	
November	12.616		12.769		57.253	
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42.400	
February	41.614	42.962	August	43 319	
March	40.157	42.577	September	39.755	
April	42.185		October	41.185	
May	43.115		November	43.125	
June	44.606		December	44.655	
			Av. Year	42.281	

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412		4.262		12.889	
May	4.373		4.223		12.984	
June	4.435		4.292		13.260	
July	4.499		4.397		13.530	
August	4.500		4.406		14.260	
September	4.485		4.356		14.744	
October	4.265		4.139		15.332	
November	4.298		4.181		15.821	
December	4.450		4.332		15.648	
Year	4.420		4.286		13.970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399		5.249		23.743	
May	5.348		5 198		24.375	
June	5.520		5 370		24.612	
July	5.695		5 545		25.006	
August	5.953		5 803		26 801	
September	5 869		5 719		27 750	
October	6.102		5.951		27.256	
November	6.380		6.223		26.795	
December	6.301		6.151		26.849	
Year	5.758		5.608		25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90		14.65		15.00	
May	15.90		14.30		14.72	
June	15.90		14.06		14.56	
July	15.90		14.03		14.53	
August	15.90		14.00		14.47	
September	15.90		13.57		14.40	
October	15.43		13.44		14.34	
November	14.92		13.30		14.25	
December	15.15		13.10		13.90	
Year	$15.72		$13.94		$14.49	

STOCK QUOTATIONS

SAN FRANCISCO Apr. 16

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.12	Belmont	10.20
Belcher	.99	Jim Butler	.68
Best & Belcher	.19	MacNamara	.25
Caledonia	3.90	Midway	.35
Challenge Con	.30	Mont.-Tonopah	3.25
Chollar	.13	North Star	.28
Confidence	1.10	West End Con	2.17½
Con. Virginia	.70	Atlanta	.30
Crown Point	1.07½	Booth	.15
Gould & Curry	.12	C.O.D. Con	.11
Hale & Norcross	.38	Comb. Frac	.17
Mexican	3.50	Jumbo Extension	.47
Occidental	.68	Pitts.-Silver Peak	1.45
Ophir	1.37½	Silver Pick	.10
Overman	2.65	St. Ives	.33
Potosi	.12	Tramp Con	.02
Savage	.27	Argonaut	2.25
Sierra Nevada	.40	Bunker Hill	‡5.50
Union Con	1.17½	Cent. Eureka	.70
Yellow Jacket	1.47½	So. Eureka	‡5.00

N. Y. EXCH. Apr. 16

Name of Comp.	Clg.
Amalgamated	83⅝
Am. Agri. Chem	60½
Am.Sm.&Ref.,com	85⅛
Am.Sm. & Ref.,pf.	107¾
Am.Sm. Sec., pf. B	86¾
Anaconda	43
Batopilas Min	2⅞
BethlehemSteelpf	62¾
Chino	28⅞
Federal M. & S., pf.	43
Goldfield Con	4¾
GreatNor.,ore,,ctf.	40¾
Homestake	94
Miami Copper	26½
Nat'nalLead,com.	57¾
National Lead, pf.	108
Nev. Consol	19¾
Pittsburg Coal, pf.	86⅞
Ray Con	19¾
Republic I&S,com.	23½
Republic I & S, pf.	78
SlossSheffi'd,com.	47
Sloss Sheffield, pf.	‡100
Tennessee Copper	41
Utah Copper	64
U. S. Steel, com	70⅝
U. S Steel, pf.	112⅝
Va. Car. Chem	51¾

N. Y. CURB Apr. 16

Name of Comp.	Clg.
Barnes King	‡1¼
Beaver Con	.43
Braden Copper	5¾
B. C. Copper	5¾
Buffalo Mines	‡1⅛
Butte & Vipond	‡.53
Caledonia	.70
Con. Ariz. Sm	9/16
Davis-Daly	1¾
Diam'field-Daisy	11
Ely Con	5/16
Florence	.84
Giroux	5⅞
Gold Hill Con	‡⅛
Greene Cananea	9¼
Greenwater	.08
Guggen. Exp	228
Inspiration Con	19½
Internat. S. & R	126
LaGrange Placer	‡2⅞
Kerr Lake	2½
La Rose	3⅝
McKinley-Dar-Sa	14½
Min. Co. of A. new	3¼
Nev. Utah M. & S.	1/16
Nipissing Mines	8⅛
Ohio Copper	1⅝
Pacific Sm. & M	3/32
Precious Metals	‡1¾
Ray Central	2⅜
Red Warrior	‡1⅛
South Utah M. & S.	1⅛
Standard Oil (Old)	880
Stand'd Oil of N.J.	399
Stand'd Oil Subs.	508
Stewart	1⅛
Tonopah	8
Tonopah Ex	2⅝
Tri-Bullion	¾
Tularosa	1
United Cop., pfd.	15
Yukon Gold	3⅛

LONDON Apr. 17

Name of Com.	Clg.
Gamp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	1 13 3
Mexico Mines	6 17 6
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 2 0

BOSTON EXCH. Apr. 16

Name of Comp.	Clg.
Adventure	8⅝
Algomah	7⅛
Allouez	45½
Am. Zinc	26⅞
Ariz. Com., ctfs.	6
Bonanza	⅛
Boston & Corbin	7½
Butte & Balak	4½
Calumet & Ariz	73½
Calumet & Hecla	487
Centennial	23½
Con. Mercur	‡ 07
Copper Range	65
Daly West	6¾
East Butte	14½
Franklin	15
Granby	56
Hancock	32½
Hedley Gold	17
Helvetia	1¼
Indiana	18½
Island Cr'k, com.	43½
Island Cr'k, pfd.	88
Isle Royale	28
Keweenaw	1 1/16
Lake	46½
La Salle	6¼
Mass	8
Michigan	3
Mohawk	64¾
New Arcadian	5¼
New Idria Quick	‡6⅞
North Butte	33¼
North Lake	7⅛
Ojibway	5⅝
Old Dominion	53½
Osceola	115
Quincy	87
Shannon	15
Shattuck-Ariz	21
Superior	33⅝
Superior & Bost	3¼
Tamarack	41
Trinity	7⅛
Tuolumne	3⅞
Union Mines	‡2¼
U. S. Smelting	39½
U. S. Smelt'g, pf.	48¾
Utah Apex	2¾
Utah Con	14⅞
Victoria	5
Winona	6¾
Wolverine	113½
Wyandot	2½

BOSTON CURB Apr. 16

Name of Comp.	Last
Ahmeek	‡285
Bingham Mines	3½
Boston Ely	2
Boswyocolo	.03½
Butte Central	8⅜
Cactus	14
Calaveras	3 00
Chief Cons	1⅜
Corbin	2⅛
Cortez	1 1/16
Crown Reserve	3⅜
First Nat. Cop.	3 3/16
Majestic	.72
Mazatan	‡1 1/16
Moneta Porc	.19
Nevada-Douglas	4⅞
New Baltic	4
Oneco	3⅜
Raven Copper	.40
Rhode Island Coal	.10
San Antonio	‡3
S. W. Miami	8⅜
South Lake	7½
Trethewey	.60
United Verde Ext.	.43
Vulture	‡5.00

‡Last quotation.

TORONTO Apr. 16

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 25	Hollinger	12.15
Hudson Bay	170.00	Imperial	.05
Temiskaming	.40	Pearl Lake	.10
Wettlaufer-Lor	.62	Porcu. Gold	.37
Apex	.05	Porcu. Tisdale	.05
Central	5 56	Preston E. D	.08
Crown Chartered	‡ 28	Rea	.40
Dobie	.40	Standard	.04
Dome Exten	.61	Swastika	.23
Foley O'Brien	.31	West Dome	.38

COLO. SPRINGS Apr. 16

Name of Comp.	Bid.
Acacia	‡.05½
Cripple Cr'k Con.	‡ 01½
C. K. & N.	‡ 17½
Doctor Jack Pot.	.06½
Elkton Con	.66½
El Paso	.80
Findlay	.04
Gold Dollar	.14
Gold Sovereign	‡ 02½
Isabella	.12½
Jack Pot	.06
Jennie Sample	.04
Lexington	‡ 01
Moon Anchor	‡ 01
Old Gold	‡ 03½
Mary McKinney	.65
Pharmacist	‡.01½
Portland	.90
Vindicator	.70
Work	‡.01

SALT LAKE Apr. 16

Name of Comp.	Bid.
Beck Tunnel	.15½
Black Jack	.20
Cedar Talisman	.02
Colorado Mining	.30
Columbus Con	.21
Crown Point	.04½
Daly-Judge	5.95
Grand Central	.65
Iron Blossom	1.35
Little Bell	.35
Lower Mammoth	.04
Mason Valley	12.00
May Day	.14
Nevada Hills	2.40
New York	.06
Prince Con	1.70
Silver King Coal'n	1.70
Sioux Con	.03½
Uncle Sam	.22
Yankee	.10